GE Fanuc Automation

CIMPLICITY® Monitoring and Control Products

CIMPLICITY HMI Plant Edition

Base System

Device Communications Manual

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Preface

Content of this Manual

This manual is composed of the sections described below.

Chapter 1: Allen-Bradley Communications: Describes the Allen-Bradley Communications enabler.

Chapter 2. Allen-Bradley Data Highway Plus Communications: Describes the Allen-Bradley Data Highway Plus communications option.

Chapter 3. Allen-Bradley DF1: Describes the CIMPLICITY Allen-Bradley Communication Enabler, which can be used to communicate with Allen-Bradley Programmable Controllers through the DF-1 serial communication protocol.

Chapter 4: Allen-Bradley Intelligent Antenna Communications: Describes the Allen-Bradley options that uses the computer's local serial ports, or a remote terminal server

Chapter 5. APPLICOM Communications: Describes the APPLICOM communications option.

Chapter 6. CCM2 Communications: Describes the CCM2 communications option for GE Fanuc programmable controllers.

Chapter 7. DDE Client Communications: Describes the DDE Client communications option.

Chapter 8: FloPro/FloNet Communications: Describes FloPro, a program that runs on IBM PC compatible computers and lets them perform functions similar to PLCs. and the FloNet cards

Chapter 9. Genius® Communications: Describes the Genius communications option for GE Fanuc programmable controllers.

Chapter 10: Honeywell IPC 620 Communications: Describes the Honeywell Asynchronous Byte Count (ABC) Protocol Device.

Chapter 11. Johnson Controls N2 Communications: Describes the Mitsubishi A-Series Serial communications option.

Chapter 12. Mitsubishi A-Series Serial Communications: Describes the Mitsubishi A-Series Serial communications option.

Chapter 13. Mitsubishi TCP/IP Communications: Describes the Mitsubishi TCP/IP communications option.

Chapter 14. Modbus Plus Communications: Describes the Modbus Plus Communications option.

Chapter 15. Modbus RTU Communications: Describes the Modbus RTU communications option.

Chapter 16. Modbus RTU Slave Communications: Describes Modbus RTU Slave Communications option that supports a multi-drop configuration with the Modbus RTU Slave Communications enabler functioning as a slave. .

Chapter 17. Modbus TCP/IP Communications: Describes the Modbus TCP/IP communications option.

Chapter 18. Modbus/TCP Slave Communications: Describes the Modbus/TCP Slave Communications option that supports a multi-drop configuration with the Modbus/TCP Slave Communications enabler functioning as a slave

Chapter 19. OMRON Host Link Communications: Describes the OMRON Host Link communications option

Chapter 20. OMRON TCP/IP Communications: Describes the OMRON TCP/IP communications option.

Chapter 21: OPC Client: Describes the OPC Client software that gives users access to an OPC server.

Chapter 22. Series 90 TCP/IP Communications: Describes the Series 90 TCP/IP communications option for GE Fanuc programmable controllers.

Chapter 23. Seriplex Communications: Describes the Seriplex communications option.

Chapter 24. Sharp TCP/IP Communications: Describes the Sharp TCP/IP communications option.

Chapter 25. Siemens TI Communications: Describes the Siemens TI communications option.

Chapter 26. Smarteye Electronic Assembly Communications: Describes the Smarteye Electronic Assembly communications option.

Chapter 27. SNP and SNPX Communications: Describes the SNP/SNPX communications option for GE Fanuc programmable controllers.

Chapter 28. Square D SY/MAX Communications: Describes the Square D SY/MAX communications option.

Chapter 29: Toyopuc Ethernet Device Communication Module: Describes the connections with Toyopuc programmable controllers.

Chapter 30. Series 90 TCP/IP Triplex Communications: Describes the Series 90 TCP/IP Triplex enabler.

Related Publications

For more information about CIMPLICITY software, refer to these publications:

CIMPLICITY HMI Base System User Manual (GFK-1180). This book describes all the basic features on the CIMPLICITY HMI for Windows NT and Windows 95 product.

Also, the "Related Documentation" section of each device's chapter contains a list of suggested documents you should have on hand for that device.

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Allen-Bradley Communications

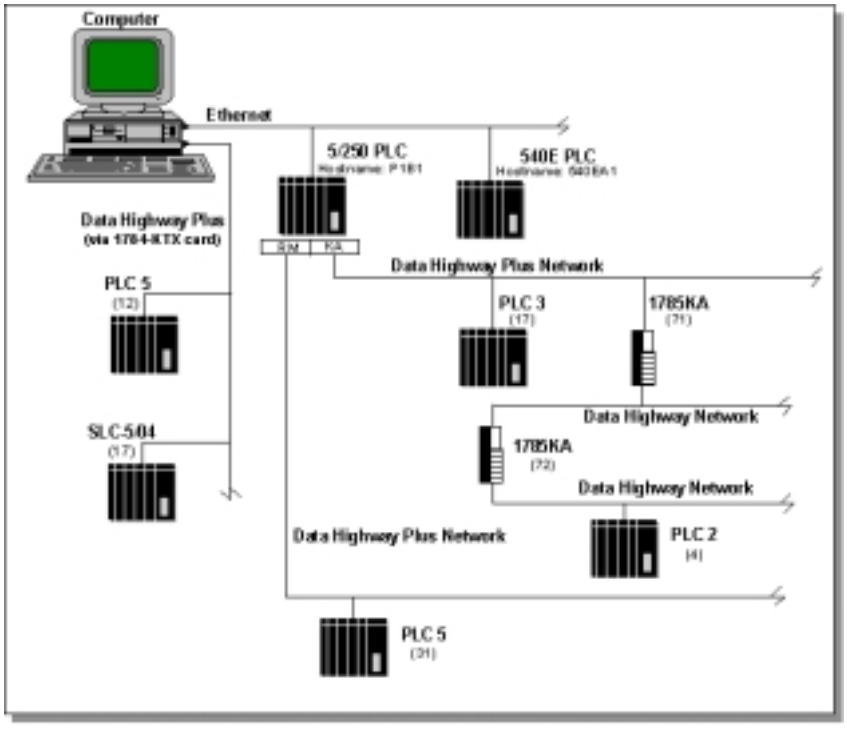
About Allen-Bradley Communications

The Allen-Bradley Communications enabler lets you exchange data between CIMPLICITY HMI software and Allen-Bradley PLC processors.

This enabler is built with Allen-Bradley's RSLinx™ software and the CIMPLICITY HMI Device Communications Toolkit. The Device Communications Toolkit provides the interface to CIMPLICITY HMI software and a structured environment for constructing device interfaces. The RSLinx software provides a library of function calls that are embedded in the toolkit code to perform the actual device interface and data exchange.

The physical communications link between a CIMPLICITY HMI computer and the PLC processors is an Ethernet network or a Data Highway Plus network via an Allen-Bradley 1784 KTX card.

Sample Allen Bradley Network



This enabler supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integer
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Allen-Bradley Communications Features

The Allen-Bradley Communications enabler provides the following features:

- Configuration functions for defining the logical communication ports used by CIMPLICITY HMI software for the device interface. A device communications process is attached to each port, and up to four communication processes can be configured for a CIMPLICITY HMI computer.
- Configuration functions for defining the devices accessed via each communication port and the data or "points" to be exchanged.
- Asynchronous exchange of data between CIMPLICITY HMI software and a variety of devices.
- Support for collecting data from the Allen-Bradley processors via unsolicited data messages.
- Alarm generation when a communication failure occurs.
- A utility program for Ethernet communications, **`abiping.exe`**, which is used for validating the network addresses that must be specified for each device to which communications are to be established.

Required Hardware/Software

You must have the following:

- Allen-Bradley RSLinx™ OEM software version 2.0
- ControlLogix Gateway with the appropriate modules and ControlLogix Gateway Configuration software (see Allen-Bradley Publication 1756-10.2 ControlLogix Gateway Configuration Software and *Communication through ControlLogix Gateway* in this chapter).

Supported Allen-Bradley Devices

The following Allen-Bradley devices are supported locally via an Ethernet link:

- Allen-Bradley PLC-5 processors with a built-in Ethernet interface such as the PLC-5/20E™, PLC-5/40E™, or PLC-5/80E™
- Allen-Bradley PLC-5/250 Pyramid Integrator Systems with an Ethernet Interface Module (5820-EI)

The following Allen-Bradley devices can be accessed through a 1784-KTX card:

- PLC-5 Family PLCs

  PLC-5/12 (1785-LT3), PLC-5/25 (1785-LT2)

- SLC-5/04

The following Allen-Bradley devices can be accessed remotely through a Pyramid Integrator via a Resource Manager Module (5130-RM1, RM2), or a KA Data Highway / Data Highway Plus Interface Module (5130-KA).

- PLC-5 Family PLCs

  PLC-5/12 (1785-LT3), PLC-5/25 (1785-LT2)

- PLC-2 Family PLCs

  PLC-2, 2/20 (LP1), MINI PLC-2, 2/20 (LP2), PLC-2/15, 2/16, 2/17, 2/30, 2/02, 2/05

  DH/DH+ interfaces: 1171-KC, 1171-KD, 1771-KA2, 1771-KA, 1771-KA4, 1771-KE, 1771-KF, 1770-KF2, 1771-KG, 1771-KGM, 1785-KA3

- PLC-3 with one of the following DH/DH+ interfaces: 1771-KA, 1775-SA, 1775-SR5, 1775-KA-232, 1775-S5, and 1775-SR5 (new revisions)
- PLC-5/250
- Supported PLCs via a 1785-KA Bridge using off-link addressing
- SLC-5/04

Supported File Types

For PLC-3, PLC-5/250, and PLC-5 devices, data can be read and written to the following file types:

File Type	Description	Comments
N	Integer	
I	Input	Not supported for PLC-5/250 or SLC-5/04
O	Output	Not supported for PLC-5/250 or SLC-5/04
F	Floating Point	Not supported for SLC-5/04
B	Bit	
T	Timer	PLC-5/250 CTL field is read-only
C	Counter	PLC-5/250 CTL field is read-only
S	Status	
A	ASCII	Not supported for PLC-5/250
D	BCD	Not supported for PLC-5/250 or SLC-5/04
H	High Order Integer	PLC-3 only
L	Long Integer	PLC-5/250 only
R	Control	Not supported for PCL-3 PCL-5/250 CTL field is read-only

For points in the Floating Point (F) file type, use the FLOATING point type.

For points in the BCD (D) file type, use the 3D_BCD or 4D_BCD point type.

When using Recipe Management to read and write in Floating Point files, only FLOATING point types are supported.

For the PLC-2, data can be read from and written to Register Memory only.

Required Allen-Bradley Software

You must install Allen-Bradley RSLinx OEM software for Windows NT version 2.0 or higher. The part number to be used when ordering the RSLinx OEM software is 9355WABOEM.

If you need the **bootpd** service, you must call Rockwell Software for the latest copy of the **bootptab** file. The file is self-documenting.

Important

A sample **bootptab** file is included in the *Installation Procedure* section. If your file differs from the sample, follow the instructions in your **bootptab** file for adding PLC/5-xxE Ethernet processors and 5820-EI Ethernet Interface modules.

Allen-Bradley Related Documents

You should have one or more of the following documents available when configuring your communications network:

RSLinx OEM User's Guide

RSLinx Installation Procedures

The RSLinx installation procedure you use depends on whether you are installing Ethernet communications or 1784-KTX communications.

Ethernet Communications RSLinx Installation Procedure

Follow the instructions found in the Allen-Bradley RSLinx software to:

1. Install the RSLinx software.
2. Configure at least one Windows NT computer to serve as Ethernet Boot server for the EI modules and Ethernet PLC-5 processor. If you need a **`bootpd`** service for your Windows NT computer, use the Allen-Bradley **`bootpd`** utility. Use the **`bootptab`** file provided to you by Rockwell Software and enter the information for your devices as instructed.
3. Create a LMHOSTS file in a directory of your choice, and use *Notepad* to enter the PLC IP address, node name and alias for each EI module and Ethernet PLC-5 processor. The format is:

   `<IP_Address>  <node_name>  <alias>`
4. Import the LMHOSTS file. See below for detailed instructions if you do not know how to do this.
5. Use the Rockwell Software *RSLinx OEM* driver configuration to configure the RSLinx Ethernet to PLC-5 or 5820-EI driver to communicate with the PLC-5 or EI module processors. Follow the instructions in your RSLinx documentation to do this.

Sample bootptab File

The following is an example of a **bootptab** file:

```
#
# Legend:
#      bf -- bootfile
#      gw -- gateways
#      ha -- hardware address
#      ht -- hardware type
#      ip -- host IP address
#      sm -- subnet mask
#      vm -- BOOTP vendor extensions format

defaults5E: ht=1:vm=rfc1048
defaultsPI: ht=1:vm=rfc1048:hd="c:/rsi/bootpd":bf=sgmpccc.bin
# Copy and modify this entry for each PLC/5-xxE Ethernet processor:
# 1.   Change plc5name to the host name of the processor.
# 2.   Change aa.bb.cc.dd to the processor's IP address.
# 3.   Change xxyy to the last 4 digits of the processor's Ethernet
#      hardware address.  This is found on a printed label on the top
#      edge of the circuit board, in the form 00-00-BC-1C-xx-yy.
#plc5name: tc=defaults5E:ip=aa.bb.cc.dd:ha=0000BC1Cxxyy
ALPLCE:tc=defaults5E:sm=255.255.255.0:ip=205.133.104.112:ha=0000BC1C05bd

# Copy and modify this entry for each 5820-EI Ethernet Interface module
# 1.   Change einame to the host name of the module.
# 2.   Change aa.bb.cc.dd to the module's IP address.
# 3.   Change xxyy to the last 4 digits of the module's Ethernet
#      hardware address.  This is found on a printed label on the top
#      edge of the circuit board, in the form 00-00-BC-01-xx-yy.
#einame: tc=defaultsPI:ip=aa.bb.cc.dd:ha=0000BC01xxyy
```

Sample LMHOSTS File

The following is an example of a LMHOSTS file:

```
205.133.104.111    abplcd    ALPLCD
205.133.104.112    abplce    ALPLCE
```

Importing an LMHOSTS File

To import your LMHOSTS file, do the following:

1. From the **Start** menu, select **Control Panel**.
2. In the *Control Panel* group, select *Network*.
3. In the *Network Settings* dialog box, select the *Protocols* property page.
4. On the *Protocols* property page, double-click on **TCP/IP Protocol** in the **Network Protocols** list.
5. In the *Microsoft TCP/IP Properties* dialog box, select the *WINS Address* property page.
6. In the *WINS Address* property page, select **Import LMHOSTS...**.
7. In the *Open* dialog box, specify the pathname for your LMHOSTS file, then select **Open**.
8. When the import is complete, select **Cancel** in the *Microsoft TCP/IP Properties* dialog box and the *Network Settings* dialog box.

1784-KTX Data Highway Plus Communications RSLinx Installation Procedure

You must configure the 1784-KTX card using the RSLinx Driver Configuration software. You cannot use the configuration driver supplied with the 1784-KTX card.

Follow the instructions found in the Rockwell RSLinx software to install the RSLinx software.

Use the Rockwell Software *RSLinx OEM* driver configuration to configure the 1784-KTX card. Follow the instructions in your RSLinx documentation to do this. See the following sections in the on-line Help for RSLinx software:

- How to Configure Communications Hardware
- How to Configure Communications Drivers

Allen-Bradley Communications Ethernet Installation Verification

You can do the following to verify your installation:

- In *RSLinx OEM*, run the **SuperWho** utility to verify that the RSLinx driver has detected the existence of the configured PLC-5 or EI module processors on the Ethernet.
- Run the **abiping.exe** program.

Using abiping.exe

The **abiping.exe** program is provided to assist you in validating the network address to be configured for a device and verifying the communications link. This program is invoked by using the following command:

```
\CIMPLICITY\exe\abiping.exe PLCX Netname Port_id
station_num
```

where:

PLCX can be PLC2, PLC3, PLC5, or PLC5250

Netname, **Port_id** and **station_num** are as described in the Device Configuration section.

This is especially helpful when your communications network contains gateways and bridges.

If you enter a valid network address and your communications hardware is properly installed, the following message displays:

```
Communications successfully detected the device
```

If you enter an invalid address or your communication link is not operating properly, a message similar to the following displays:

```
Unable to successfully DTL_C_CONNECT to Device
Status = 158 address >PLC2< hi_xd = 0
```

Important: Enter the station ID in RSLINX software in Decimal format. In ABIPING, enter the address in Octal.

Examples of Valid Ethernet Network Addresses

The sample network, shown on page 1-1, depicts a PLC network utilizing a CIMPLICITY HMI computer using Allen-Bradley Communications to:

- Communicate to various PLCs directly over Ethernet, through a PLC-5/250 and other bridge devices, and through a 1784-KTX card.
- Communicate to various PLCs via a 1784-KTX card using Data Highway Plus protocol.

The network address for CIMPLICITY HMI device configuration has following format :

Driver_name, Port_id, Station_number

The network address for each device in the sample Ethernet network is:

Device	Address
PLC-5/250	AB_ETH-1,AB:LOCAL,1
PLC-540E	AB_ETH-1,AB:LOCAL,2
PLC-5	AB_ETH-1, AB:PIGATEWAY/P:0/M:RM/C:2/E:1,31 Communication is via the Resource Manager in the 5/250 on channel 2
PLC-3	AB_ETH-1,AB:PIGATEWAY/P:1/M:KA/C:2/E:1,6 Communication is via the KA module in the 5/250 on channel 2 This example assumes that the pushwheel setting on the KA Module is 1.
PLC-2	AB_ETH-1,AB:PIGATEWAY/B:71/P:1/M:KA/C:2/E:1/KA,4 Communication is via the KA module in the 5/250 on channel 2, a 1785KA bridge, and a 1785KA module

The network address for each device in the sample Data Highway Plus network is.

Device	Address
PLC-5	AB_KT-1,AB:LOCAL,12
SLC-5/04	AB_KT-1,AB:LOCAL,17

Note

When directly connected to the Data Highway Plus network via the 1784-KTX adapter, the driver name is **AB_KT-1**, the Port ID is **AB:LOCAL**, and the Station Number is the number assigned to the PLC.

Refer to the *Device Configuration* section of this document for information on the format of the network address.

Refer to the ***RSLinx Reference Manual*** for additional detailed information on offlink addressing.

CIMPLICITY Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to the Allen-Bradley Communications enabler.

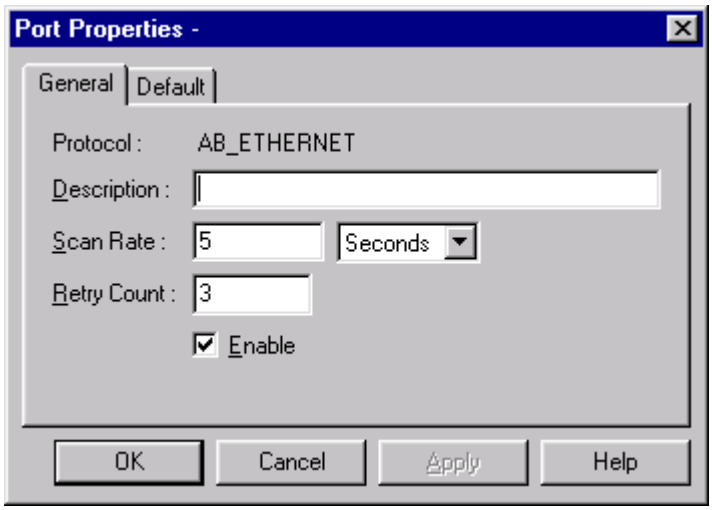
Port Configuration

When you configure a port for Allen-Bradley Communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **AB_ETHERNET** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for Allen-Bradley Communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

General Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description Enter an optional description to help you identify the port.

Scan Rate Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count If communications cannot be established to a device on the port, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once the device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Default Properties

The *Default* properties are not used for Allen-Bradley Communications.

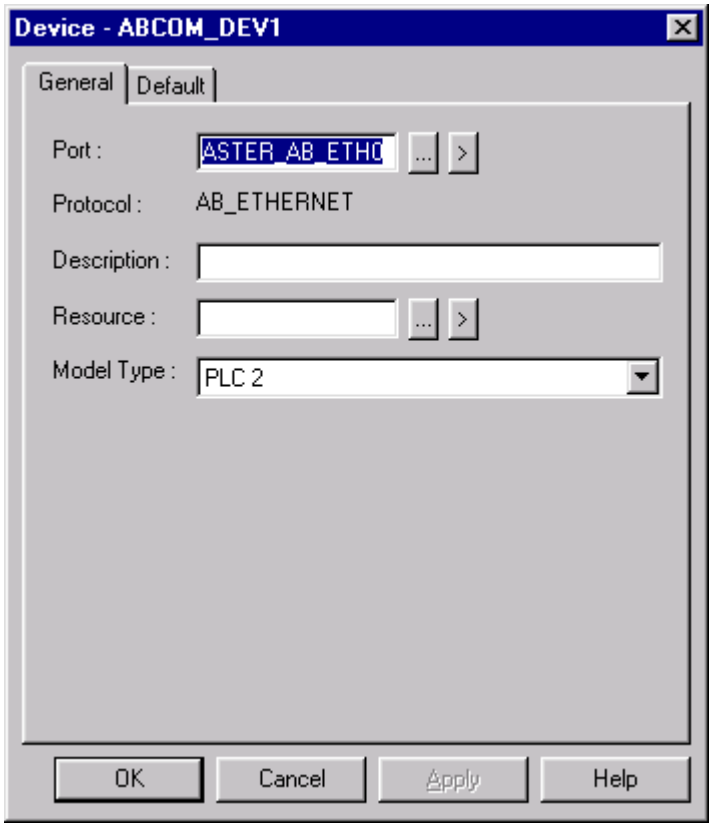
Device Configuration

When you create a device for Allen-Bradley Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Allen-Bradley Communications port to be used for the device.

When you select **OK** to create the device, the *Device Properties* dialog box for devices using this protocol opens.

General Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

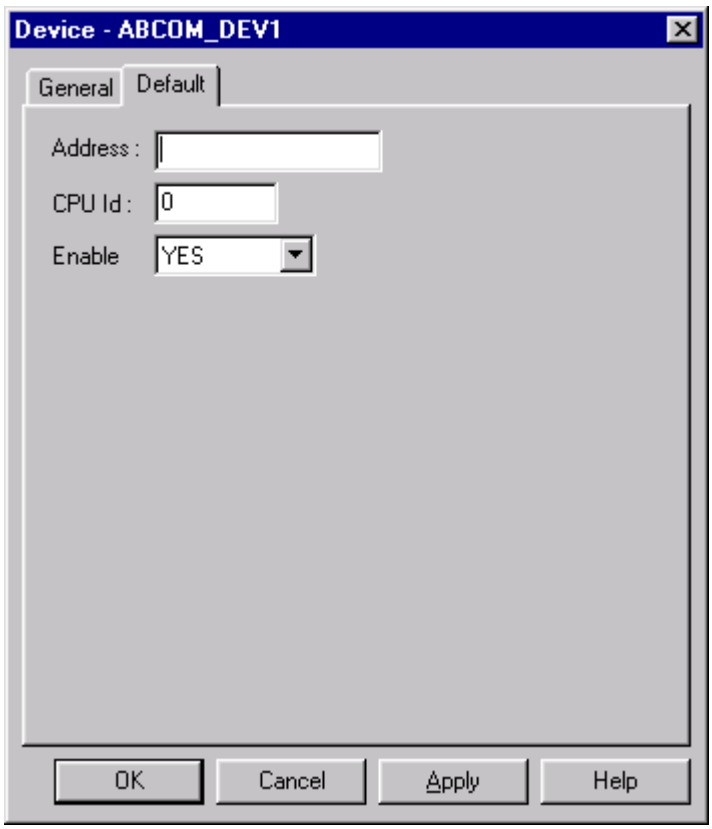
Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button - - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the choices are:

PLC 2	**PLC 5**
PLC 3	**PLC 5/250**
SLC-5/04	

Default Properties



Use the *Default* properties to enter information about Allen-Bradley Communications for the device. You can define the following:

Address Enter the Network Address for the device.

The network address for CIMPLICITY device configuration has following format :

Driver_name, Port_id, Station_number

where:

Driver_name is the name of the driver user configured in the Rockwell Software *RSLinx OEM* driver configuration.

- For the Ethernet driver, use **AB_ETH-1**.
- For the 1784-KTX Data Highway Plus driver, use **AB_KT-1**.

Port_id has the following format :

AB:KEYWORD/B:b/L:l/G:g/P:p/M:m/C:c/E:e/KA

where:

KEYWORD is the port type. Valid port types are:

LOCAL
OFFLINK
PIGATEWAY
DF1MASTER

/B:b is the bridge address in the range from 1–376 (octal).

/L:l is the Destination Link ID in the range from 0–65535 (decimal).

/G:g is the Gateway to final DH-485 Link in the range from 1–367 (octal).

/P:p is the Pushwheel Number in the range from 0–4 (Ethernet).

/M:m is the Module Type. Valid types are:

RM
KA

/C:c is the Channel Number. Valid numbers are 0, 2 or 3.

/E:e is the Station number used in the Rockwell Software *RSLinx OEM* driver configuration.

The number is an *octal* number in the range of 0-77 (RSLinx software used a *decimal* number here).

If you are using the CIMPLICITY HMI Host Redundancy option *and* the KT or KTX card, do not use the **/E:e** option.

/KA is used if the Bridge requires 1785-KA addressing mode.

/KA is required to communicate through a 1785-KA from Data Highway Plus to Data Highway.

If you need help defining the **Port ID**, see your Allen-Bradley network administrator.

Station_number specifies the station number of a remote processor on an Allen-Bradley network.

Valid station numbers are :

- For Ethernet, use the station number used in the RSLinx Ethernet driver configuration. The number is an *octal* number in the range of 0-77 (RSLinx software uses a *decimal* number).
- For Data Highway channels, 1-376 (octal).
- For Data Highway Plus channels, 0-77 (octal).
- For Data Highway-485 channels, 0-37 (octal).
- For RS-232 Full Duplex DF1, 0-77 (octal).

CPU ID *Not used.*

Enable Select **Yes** in this box to enable the device when the project starts. Select **No** in this box to disable the device. Points associated with the device will be unavailable.

Point Configuration

When you define a point, the following fields have values that are unique to or have special meanings for the Allen-Bradley Communications enabler.

General Page

On the *General* property page, you may configure points for **Read** or **Read/Write** access.

When you are reading / writing data between CIMPLICITY software and a Floating Point file (F), define CIMPLICITY points using the REAL data structure type.

When you are configuring array points, make sure that the size of the array is within the limits of the file. CIMPLICITY software does not declare an array configured beyond the end of a file as invalid.

Device Page

On the *Device* property page:

Address

Point address requirements are device dependent. Valid devices are:

PLC-2
PLC-3
PLC-5
PLC-5/250
SLC-5/04

Update Criteria

The update criteria determine how the data will be requested.

Enter **On Change** or **On Scan** for points whose values should be polled by the Allen-Bradley Communications enabler at regular intervals.

Enter **On Demand On Change** or **On Demand On Scan** for points whose values should be polled by the Allen-Bradley Communications enabler at regular intervals while users are displaying them.

Enter **Unsolicited** for points that will accept unsolicited data.

Enter **Poll Once** for points that are to be polled once when the Allen-Bradley Communications enabler starts.

When you are configuring Boolean points, you must also enter data in the following field:

Bit Offset

Enter the bit offset that corresponds to the bit position within the word. The valid range for bit offset is 0–15 where 0 is the least significant bit. The bit offset must be specified as a decimal value.

Point Address Formats

PLC-2 Address Formats

PLC-2 devices support the following address formats:

File Type	Address Format
R	**<ELEMENT>** where **<ELEMENT>** is an octal offset

PLC-3 Address Formats

PLC-3 devices support the following address formats:

File Type	Address Format
D, A, H, S, N, F, B	**<FILE><FILE NUMBER>:<ELEMENT>** The use of leading zeros when specifying the **<FILE NUMBER>** and **<ELEMENT>** is *not* supported.
I, O	**<FILE><FILE NUMBER>:<OFFSET>** where **<FILE>** is **I** for inputs or **O** for outputs.
T, C	**<FILE><FILE NUMBER>.<TYPE>** where **<TYPE>** is one of the following: **ACC** - Accumulator **PRE** - Preset **CTL** - Control Word Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	**Offset**	**Control Bit**	**Offset**
CU	15	EN	15
CD	14	TT	14
DN	13	DN	13
OV	12		
UF	11		
EN	10		
ZR	9		
FN	8		

PLC-5 Address Formats

PLC-5 devices support the following address formats:

File Type	Address Format
D. A. N, F, B	**<FILE><FILE NUMBER>:<ELEMENT>**
	The use of leading zeros when specifying the **<FILE NUMBER>** and **<ELEMENT>** is *not* supported.
S, I, O	**<FILE>:<OFFSET>**
	where **<FILE>** is **I** for inputs, **O** for outputs, and **S** for status.
T, C, R	**<FILE><FILE NUMBER>:<ELEMENT>.<TYPE>**
	where **<TYPE>** is one of the following:

ACC - Accumulator
PRE - Preset
CTL - Control Word
LEN - Length (R only)
POS - Position (R only)

Accumulators, Presets, and Control Words are 16 bits.

Bit offsets for the Control Word (CTL) in Controls are:

Control Bit	Offset	Control Bit	Offset
EN	15	ER	11
EU	14	UL	10
DN	13	IN	9
EM	12	FD	8

Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	**Offset**	**Control Bit**	**Offset**
CU	15	EN	15
CD	14	TT	14
DN	13	DN	13
OV	12		
UN	11		

PD	**<FILE NUMBER>:<ELEMENT>**
	For more information about using this file type, see *PLC-5 PD File Support* below.

PLC-5/250 Address Formats

PLC-5/250 devices support the following address formats:

File Type	Address Format
N, F, B, L	**<MODULE><FILE> <FILE NUMBER>:<ELEMENT>** The use of leading zeros when specifying the **<FILE NUMBER>** and **<ELEMENT>** is *not* supported.
S	**<MODULE><FILE>:<OFFSET>**
I, O	**<FILE>:<OFFSET>** where **<FILE>** is **I** for inputs or **O** for outputs.
T, C, R	**<MODULE><FILE> <FILE NUMBER>:<ELEMENT> .<TYPE>** where **<TYPE>** is one of the following: **ACC** - Accumulator **PRE** - Preset **CTL** - Control Word **LEN** - Length (R only) **POS** - Position (R only) Accumulators and Presets are 32 bits, and Control Words are 16 bits. Accumulators, Presets, and Control words for Counters are 16 bits.

Note

For PLC-5/250 devices, Control Words are *read-only*.

Bit offsets for the Control Word (CTL) in Controls are:

Control Bit	Offset	Control Bit	Offset
EN	15	ER	11
EU	14	UL	10
DN	13	IN	9
EM	12	FD	8

Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	Offset	Control Bit	Offset
CU	15	EN	15
CD	14	TT	14
DN	13	DN	13
OV	12		
UN	11		

SLC-5/04 Address Formats

SLC-5/04 devices support the following address formats:

File Type	Address Format
A, N, B	**<FILE><FILE NUMBER>:<ELEMENT>**
	The use of leading zeros when specifying the **<FILE NUMBER>** and the **<ELEMENT>** is *not* supported.
S	**<FILE>:<OFFSET>**
T, C, R	**<FILE><FILE NUMBER>:<ELEMENT>.<TYPE>**
	where **<FILE>** is **T** for timers or **C** for counters, and **<TYPE>** is one of the following: **ACC** - Accumulator **PRE** - Preset **CTL** - Control Word **LEN** - Length (R only) **POS** - Position (R only) Accumulators, Presets and Control Words are 16 bits.

Bit offsets for the Control Word (CTL) in Controls are:

Control Bit	Offset	Control Bit	Offset
EN	15	ER	11
EU	14	UL	10
DN	13	IN	9
EM	12	FD	8

Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	**Offset**	**Control Bit**	**Offset**
CU	15	EN	15
CD	14	TT	14
DN	13	DN	13
OV	12		
UN	11		

PLC-5 PD File Support

PD File structures are extremely large (41 real values) and can be addressed using two different methods.

- The first method addresses the complete 41word real array (164 bytes) so that the entire PD structure can be read/written.

For example: PD30:5 returns 164 bytes.

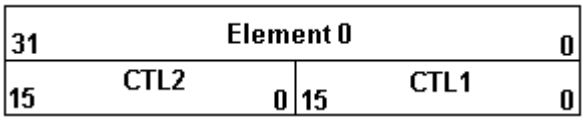
You can access multiple PD structures by creating larger arrays, which would be in increments of 41 real words or 164 bytes.

- The second method of addressing is to access each PID Mnemonic individually by using the .XXX format.

For example: **PD30:5.SP** returns the Setpoint value.

These points may also be accessed as arrays. For example, to read the 8 setpoint values for **PD30:0.SP** through **PD30:7.SP**, you can create a standard real array of 8 elements with a starting at address at **PD30:0.SP**.

The first two mnemonics in the array are actually short integers called CTL1 and CTL2. These integers are mapped into the first real array value like this:



When you request CTL1 or CTL2 the appropriate 16 bit unsigned integer is returned.

The table below identifies each item within the array so that they can be paired up with their mnemonic. Information for this table can be found in the ***Rockwell Software Hardware Interface Configuration User's Guide*** and the ***Instruction Set Reference*** for PLC-5 Programmable Controllers. Bit access mnemonics are not implemented. They are supported using the same method as Timers and Counters. The particular bits are also listed in the table below.

Mnemonic	Bit	Index as Real	Description
CTL1		0	Control Word 0
EN	15		Enable
CT	9		Cascaded Type
CL	8		Cascaded Loop
PVT	7		Process variable tracking
DO	6		Derivative action
SWM	4		Set Output
CA	2		Control Action
MO	1		Mode
PE	0		PID Equation

CTL2			0	Control Word 1
	INI	12		PID Initialized. This bit is cleared during pre-scan
	SPOR	11		Set Point out of range
	OLL	10		Output alarm, lower limit
	OLH	9		Output alarm, upper limit
	EWD	8		DB set when error is in DB
	DVNA	3		Error is alarmed low
	DVPA	2		Error is alarmed high
	PVLA	1		Process variable (PV) is alarmed low
	PVHA	0		Process variable (PV) is alarmed high
SP			1	Setpoint
KP			2	Proportional/Controller Gain
KI			3	Integral Gain/Reset term
KD			4	Derivative gain/Rate Term
BIAS			5	Feedforward or bias
MAXS			6	Maximum scaling
MINS			7	Minimum scaling
DB			8	Dead band
SO			9	Set Output
MAXO			10	Maximum output limit (% of output)
MINO			11	Minimum output limit (% of output)
UPD			12	Loop update time (seconds)
PV			13	Scaled PV value
ERR			14	Scaled error value
OUT			15	Output
PVH			16	Process variable high alarm value
PVL			17	Process variable low alarm value
DVP			18	Error high alarm value
DVN			19	Error low alarm value
PVDB			20	Process variable alarm deadband
DVDB			21	Error alarm deadband
MAXI			22	Maximum input value
MINI			23	Minimum input value
TIE			24	Tieback value for manual control
			25-40	Internal storage

Defining Points for Unsolicited Data

The Allen-Bradley Ethernet Device Communications Interface can process unsolicited data messages in PLC-2 style format. Unsolicited data can be generated by PLCs, which are directly connected to the Ethernet, such as PLC-5 E series and 5/250 systems. PLCs that are connected to Data Highway or Data Highway Plus networks can indirectly send messages through a bridge such as a 5/250 Resource Manager.

You can configure unsolicited data points via the Device Point Configuration transaction by specifying an address in the following format:

point address>application address

where:

point address is the memory location in the PLC as described in the previous section. This address must be specified in Uppercase.

application address is a unique tag that identifies the unsolicited data item. This is an octal value and must be in the range of 0 – 77777.

Example: **N7:10>020**

The application address is a logical identifier for CIMPLICITY software, and the data will be mapped to the point address.

Rules For Defining Unsolicited Points

The following rules also apply when defining unsolicited data points:

Application Addresses

Rules for application addresses include:

- An application address must be unique for each point on your computer.
- An application address does not have to be sequentially assigned.
- The same application address can be used for multiple devices communicating to the same CIMPLICITY device communications process. When multiple Allen-Bradley Ethernet device communications processes are configured for a CIMPLICITY host computer, the same application address cannot be sent through the same network interface to two different CIMPLICITY device communications processes.
- You cannot dynamically update the application address for an unsolicited data point.

The application address is used to identify the CIMPLICITY point to the RSLINX interface software. As a result, there are several restrictions that must be applied to the use of application addresses with unsolicited point data:

- For each unsolicited message that a device sends to your CIMPLICITY project you must configure a device point with an application address. Configure the device point to have the exact same size and data type as the message being sent. Also the application address should match the CIF offset of that message.

  For example, if you are sending a message containing integers from N7:20 to N7:40 (inclusive) at CIF offset 3, you should configure a point of type INT or UINT with 21 elements at the address N7:20>3.

- If you use the **ALL_UNSO** parameter and configure additional overlapping points for an unsolicited message, the additional points should not have an application address in their point address and do not need to be the exact same size as the unsolicited message.

- To insure that unsolicited communications is correctly initiated for every message, points that have been configured with an application address should never be configured as Delay Load point or as Just-in-time attributes of a point object.

Data Type and Size

The data type and size of the data transmitted via an unsolicited message must match exactly the type and size configured for the CIMPLICITY point to be used for this data. For example, if ten 16-bit unsigned analog values are being transmitted in a message, a CIMPLICITY data structure **Type** of UINT with an **Element** attribute of 10 (ten) will be required. Messages that do not conform will cause an error code to be generated, and the data point will not be updated.

When multiple devices route unsolicited messages through the same PLC 5/250 to the same CIMPLICITY device communications process, and use the same application address, the data type and size of the messages must match exactly the type and size configured for the CIMPLICITY point.

Note

If possible, you should use unique application addresses for all messages being routed through a specific PLC 5/250.

Update Criteria

You must specify the **Update Criteria** attribute as UNSOLICITED when configuring an unsolicited data point.

Array Points

When configuring CIMPLICITY data points for an unsolicited data message that contains a block of data from a PLC, a CIMPLICITY array point must be configured. The **Element** attribute specifies the number of data points contained in the message, and the **Address** specifies the starting address where the data is to be mapped.

For example, if the unsolicited data consists of one register, a single point with an address of **N7:10** is updated with the unsolicited data. If the unsolicited data message contains 10 registers of data, then: element [0] of the array point contains the data for the address **N7:10**, element [1] contains the data for **N7:11**,... , and element [9] contains the information for data originating at **N7:19**.

Certain restrictions apply to CIMPLICITY array points. For example, alarms cannot be configured for array points, and setpoint actions are not allowed.

- To circumvent these restrictions, you can configure individual points with their corresponding PLC memory addresses. These points can be configured as polled points with a very slow scan rate. They will be updated each time the scan interval occurs. You can also set a global parameter to have these individual points updated by unsolicited data messages that map to the corresponding memory addresses.
- For example, if an unsolicited data point is configured as a ten element array point with a point address of **N7:100**, you can also configure ten points addressed at **N7:100** through **N7:109**. If the multiple point update global parameter is set to "true", then each time an unsolicited data message is received for the array points, the individual points addressed at **N7:100** through **N7:109** are also updated.

Unique Point Registration

If you are implementing Allen-Bradley RSLinx applications directly, be aware that the same unsolicited points cannot be registered for both CIMPLICITY software and your application. Conflicts in these Allen-Bradley RSLinx resources may cause either your application or CIMPLICITY software to be unable to receive certain unsolicited messages.

Controlling Multiple Point Updates via a Logical Definition

Since there are some applications for which you may not wish to enable these multiple point updates, this facility is controlled via a logical defined in the CIMPLICITY logical names file. This file is located in your project's **\data** directory and is named **log_names.cfg.**

To enable this multi-point update function for all device interfaces configured for your system, define the logical ALL_UNSO to "true" by adding a record similar to the following to this file:

```
ALL_UNSO|P|default|10|true
```

Since this file is a text file, you can add this record with any text editor. After the edit has been completed, you need to restart the device communications process to make the change active. In a multi-node system, you need to make this change on the node where the device communications interface is configured to run.

Alternatively, you can enable this function for a specific device communications interface by adding a logical

```
<PORT>_ALL_UNSO|P|default|10|true
```

where **<PORT>** corresponds to the CIMPLICITY port for the specific interface. For the Allen-Bradley Device Communications Interface, the valid ports are ABINT0, ABINT1, ABINT2, and ABINT3.

If a logical is not defined in the log names file, the default mode of single point update will apply.

This logical applies to all device interfaces, which are based on the CIMPLICITY Device Communications Toolkit. This applies to those interfaces provided by GE Fanuc as well as those developed by third parties.

Enabling PLC-2 Protected Writes

The Allen-Bradley Device Communications Interface utilizes unprotected writes when communicating to the PLC-2.

For applications where "Protected Writes" are required, you can configure CIMPLICITY software to use protected writes by adding a logical to the CIMPLICITY software logical names files. This file is located in your project's **\data** directory, and is named **log_names.cfg.**

To enable protected writes for all Allen-Bradley Ethernet Communications Interfaces on a specific CIMPLICITY node, define the logical PLC2_PROT_WRITE_ALL to "true" by adding a record to this file similar to the following:

```
PLC2_PROT_WRITE_ALL|P|default|10|true
```

Alternatively, you can enable this function for a specific device communications interface by adding a logical

```
PLC2_PROT_WRITE_<PORT>|P|default|10|true
```

where **<PORT>** corresponds to the CIMPLICITY port for the specific interface. For the Allen-Bradley Device Communications Interface, the valid ports are ABINT0, ABINT1, ABINT2, and ABINT3.

For example, the record that must be added to the Logical Names file to enable this feature for an interface configured for port ABINT0 is:

```
PLC2_PROT_WRITE_ABINT0|P|default|10|true
```

If a parameter is not added to the logical names file, the default mode of unprotected write will apply. You can also disable protected writes on a node or port basis by specifying the logical value as "false".

Configuring PLCs for Unsolicited Data

The following sections describe how to set up unsolicited data on Allen-Bradley PLCs. It is assumed that Allen-Bradley PLC **ICOM** configuration software is used to set up the ladder logic on PLC.

Ethernet Direct

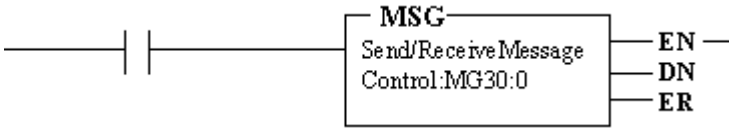
This is used for PLCs, which support direct Ethernet communication such as PLC-5/40E. It is assumed that the RSLinx Driver AB_ETH-1 is configured to include these PLCs as LOCAL.

Control Address:	Use an MG file address (ex. MG30:0)
Communication Command:	PLC-2 Unprotected Write
PLC-5 Data Table Address:	Starting address in the PLC of unsolicited data
Size In Elements:	Number of Elements of Data
*Host / Internet IP address:	IP address of CIMPLICITY host
Destination DT address:	PLC-2 data table address configured for CIMPLICITY point
Port Number:	Channel to be used for communication (ex. 2A)

***Note:** You can also use the word **CLIENT** instead of specifying the IP address. In that case, you need to configure **piunsol.ini** file on the host computer. The configuration of this file is discussed below

PLC-5 Example

The following sample message block is an example of sending an unsolicited message from a PLC-5/40E to CIMPLICITY project running RSLinx software.



Control Address:	MG30:0
Communication Command:	PLC-2 Unprotected Write
PLC-5 Data Table Address:	N55:0
Size In Elements:	2
*Host / Internet IP address:	3.26.5.205 (or CLIENT)
Destination DT address:	30
Port Number:	2A

In CIMPLICITY software, if you define an INT type array point of 2 elements with address N55:0>30, and scan type UNSOLICITED for the device sending the unsolicited data, values are updated each time the data is received from the device.

If you specify **`CLIENT`** instead of a host IP address, the following section must be included in the **`piunsol.ini`** file on the host computer.

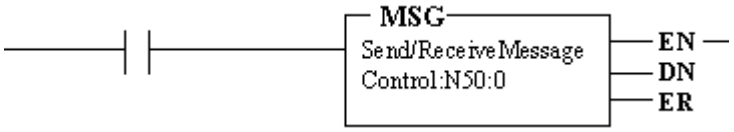
```
[plc IP address]
30=2
```

Ethernet through PI Gateway

This is used for PLCs that are connected to the CIMPLICITY host computer through a PI Gateway. The connection between the PI Gateway and CIMPLICITY software is through Ethernet, and PLCs are connected to the Gateway through a Data Highway Plus network. The unsolicited messages are sent locally on DH+ to the EI module of the PI Gateway. The **piunsol.ini** file must be configured on the host computer to receive unsolicited messages from the PI Gateway.

PLC-5 Example

The following sample message block is an example of sending unsolicited message from a PLC-5 to a CIMPLICITY host running RSLinx software through a PI Gateway.



Control Address:	N50:0
Communication Command:	PLC-2 Unprotected Write
PLC-5 Data Table Address:	N55:0
Size In Elements:	2
Local / Remote:	LOCAL
Remote Station:	N/A
Link ID:	N/A
Remote Link type:	N/A
Local Node Address:	15 (This is the DH+ node address of the EI module on the PI Gateway. It is also called the virtual port no. on PI Gateway)
Destination DT address:	30

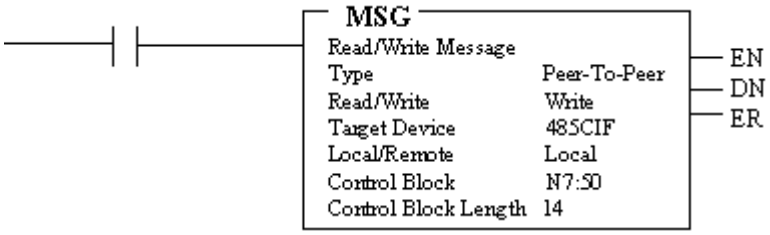
In CIMPLICITY software, if you define an INT type array point of 2 elements with address N55:0>30, and scan type UNSOLICITED for the device sending the unsolicited data, values are updated each time the data is received from the device.

The following section must be included in **piunsol.ini** file on host computer.

```
[IP address of PI Gateway]
30=2
```

SLC-5/04 Example

The following sample message block is an example of sending unsolicited message from an SLC-5/04 to a CIMPLICITY host running RSLinx software through a PI Gateway.



Control Block:	N7:50
Read/Write:	Write
Target Device:	485-CIF
Local / Remote:	Local
Channel:	1
Target Node:	13 (015) (Octal 15 is DH+ node address of EI module on PI Gateway)
Local File address:	N55:0
Target file address/offset:	48 (The target offset is in byte count. Enter PLC-2 application address*2 expressed in decimal)

In CIMPLICITY software, if you define an INT type array point of 2 elements with address N55:0>30, and scan type UNSOLICITED for the device sending the unsolicited data, values are updated each time the data is received from the device.

The following section must be included in **`piunsol.ini`** file on host computer.

```
[IP address of PI Gateway]
30=2
```

Data Highway Plus

Use this when the host computer has an KT (or KTx) card and the RSLinx driver (AB_KT) has been configured for this card. The unsolicited messages are sent locally on DH+ to the CIMPLICITY host computer. The configuration of unsolicited messages in this case is the same as described in *Ethernet through PI Gateway*. The only differences are:

- The **piunsol.ini** configuration is not required on host.
- The DH+ node address of the CIMPLICITY host is entered under **local node address**.

Configuring PIUNSOL.INI

This is a configuration file for RSLinx.

There are two cases when you need to configure the **piunsol.ini file**:

1. When the PLC sends unsolicited messages through PI Gateway.

   You need to configure the PI Gateway's IP address in the **piunsol.ini** file

2. When the PLC sends unsolicited messages directly on Ethernet by specifying **CLIENT** as destination IP address.

   You need to configure the PLC's IP address in the **piunsol.ini** file.

This file needs to be in RSLinx root directory (generally **\RSI\RSLINX**) of the host computer running the CIMPLICITY application. The format of this file is :

```
[<IP address 1>]
<application data table address> = <Number of elements>
<application data table address> = <Number of elements>
     .
     .
[<IP address 2>]
<application data table address> = <Number of elements>
<application data table address> = <Number of elements>
     .
     .
[<IP address n>]
<application data table address> = <Number of elements>
<application data table address> = <Number of elements>
     .
     .
```

where **<application data table address>** is a unique octal number associated with the unsolicited point.

For example, **30** is the application data table address in the CIMPLICITY point address **N55:0>30**. Assuming the point is configured with a size of 2 elements, then the entry is:

```
30=2
```

in the **piunsol.ini** file.

Communication through ControlLogix Gateway

Specifying the Network Address in the CIMPLICITY Device Configuration

For the AB Communications Driver, the network address for CIMPLICITY device configuration has following format:

Driver_name, Port_id, Station_number

Where:

Driver_name is the name of the driver user configured in the Rockwell Software *RSLinx OEM* driver configuration. For communicating to a remote device via a ControlLogix Gateway, use **TCP-n** where **n** is the driver number.

Port_id has the following format:

AB:KEYWORD/L:l

Where:

KEYWORD is the port type. The port types for the ControlLogix Gateway is ASA.

/L:l is the Destination Link ID of the Data Highway Plus Network to which you are bridging to (in the range from 0–65535 (decimal)).

If you need help defining the **Port ID**, see your Allen-Bradley network administrator.

Station_number specifies the station number of a remote processor on an Allen-Bradley network. For a remote device via the ControlLogix Gateway, the format is:

Port.Slot.Channel.Station

Where:

- Port is always equal to 1 for Ethernet.
- Slot is the location of the DHRIO module in the backplane.
- Channel is the DHRIO module channel. Enter 2 for channel A, or 3 for channel B.
- Station is the destination node number in decimal.

Network/Cable Redundancy Support

CIMPLICITY network/cabling redundancy for Allen Bradley Communications requires each Allen-Bradley PLC to be connected to two different physical networks.

Following are some examples of redundant networks as regards Allen-Bradley PLCs and CIMPLICITY software.

- The CIMPLICITY computer has two KT (or KTX) cards. (A combination of one KT and other KTx is also allowed). An Allen-Bradley PLC is connected to computer using two Data Highway plus networks (cables).

  In order to have these networks redundant, user has to take following steps.

  1. Configure a driver in RSLinx for each card (AB_KT-1 and AB_KT-2). The Data Highway Plus node address for the two drivers have to be different.
  2. In CIMPLICITY device configuration, provide two network addresses for the device. You can specify these addresses by separating them by a ";" (semicolon).

     For example, if the two network addresses for a device are AB_KT-1,AB:LOCAL,22 and AB_KT-2,AB:LOCAL,22, the Network Address field in device configuration is:

     ```
     AB_KT-1,AB:LOCAL,22;AB_KT-2,AB:LOCAL,22
     ```

- The CIMPLICITY computer has one Ethernet card and one KT (or KTx) card. An Allen-Bradley PLC is connected to computer using the Ethernet and Data Highway Plus networks.

  In order to have these networks redundant, user has to take following steps.

  1. Configure a driver in RSLinx for each card (AB_ETH-1 and AB_KT-1).
  2. In CIMPLICITY device configuration, provide two network addresses for the device. You can specify these addresses by separating them by a ";" (semicolon).

     For example, if the two network addresses for a device are AB_ETH-1,AB:LOCAL,22 and AB_KT-1,AB:LOCAL,22 , network address field in device configuration is:

     ```
     AB_ETH-1,AB:LOCAL,22;AB_KT-1,AB:LOCAL,22
     ```

Important

CIMPLICITY software currently does not support network redundancy for Allen-Bradley Communications when the computer has two Ethernet cards.

Features of network redundancy

A PLC, which is connected on two physical networks, is considered to be two logical devices having two different network addresses. The two devices are termed as Primary and Secondary. Only one network at a time is used to access the PLC.

CIMPLICITY network redundancy for Allen-Bradley Communications works in the following manner:

- On start-up, the Allen-Bradley Communications software uses the primary device to access the PLC.
- When the communication software determines that the primary device has failed, it switches communications to the secondary device. When this switchover occurs, **REDUND_DEVICE_DOWN** and **the communication software generates DEVICE_FAILOVER alarms**.
- If subsequently , the primary device comes up, the communication software clears the **REDUND_DEVICE_DOWN** alarm. However device communications continues to use secondary device for communication with the PLC.
- If secondary device fails while the communication software is using it, the communication software will switch back to primary device after generating proper alarms.
- As long as the communication software can talk to the PLC over a network, the device will always remain on-line (Alive).
- The device will be declared dead only when both the networks are down.

The Resource ID for all secondary devices is **$SYSTEM**. Because the Resource ID is used when **REDUND_DEVICE_DOWN** and **DEVICE_FAILOVER** alarms are generated and cleared, it is recommended that you *not* enter **$SYSTEM** in the **Resource** field when you configure redundant devices.

With this scheme, there is a single alarm listed for all **REDUND_DEVICE_DOWN** alarms on the secondary network. You can use the **View Stack** option in the Alarm Viewer to look at individual alarms.

All **DEVICE_FAILOVER** alarms are generated using Resource ID you configure for the device.

Unsolicited data

To support unsolicited data over redundant networks, you need to configure the PLC ladder logic to send the unsolicited data over both the networks. To do this, you need to use separate Application Data Table addresses for the point on the primary device and the secondary device.

To calculate the point's address on the secondary device, add 10,000 (octal) to its address on the primary device.

For example:

> You have configured an unsolicited point with address **N7:0>06** in your CIMPLICITY project. The Application Data Table address for the unsolicited point is 06. You must configure PLC ladder logic to send the unsolicited data to this Application Data Table address. If network redundancy is supported for this PLC, you also must configure the ladder to send the same unsolicited data at same time to the address 10006 (10000 + 06) over the PLC's secondary network.

Advanced Configuration Requirements

ABI_MAXDEF

By default, the Allen-Bradley Communications enabler supports a combination of 100 devices and unsolicited data messages. If the total number of devices and unsolicited data messages exceeds this number, you must define an additional logical **ABI_MAXDEF** in the **log_names.cfg** file in order to specify the number of definitions required for your installation.

The following entry would increase the maximum definitions to a value of 300.

```
ABI_MAXDEF|P|default|6|300
```

ABETH_PLC_POLL_TIMEOUT

The Allen-Bradley Communications enabler uses asynchronous requests to poll point data. By default, time-out for an asynchronous request is 10 seconds. You can use this global parameter to increase or decrease the time-out value.

To change the default time-out, add the following to the global parameter file:

```
ABETH_PLC_POLL_TIMEOUT|1|<value>
```

where **<value>** is a positive integer.

For example,

```
ABETH_PLC_POLL_TIMEOUT|1|8
```

sets the time-out value to 8 seconds.

ABETH_PLC_REQUEST_TIMEOUT

The Allen-Bradley Communications enabler uses synchronous requests during device initialization and during setpoint operations. By default, time-out for a synchronous request is 5 seconds. You can use this global parameter to increase or decrease the time-out value.

To change the default time-out, add the following to the global parameter file:

ABETH_PLC_REQUEST_TIMEOUT|1|<value>

where **<value>** is a positive integer.

For example,

ABETH_PLC_REQUEST_TIMEOUT|1|2

sets the time-out value to 2 seconds.

ABETH_PLC_RESPONSE_TIMEOUT

When the queue for point polls is nearly full the Allen-Bradley Communications enabler waits for responses to the poll requests. The default wait time is 1 second. You can use this global parameter to increase the wait time.

To change the default wait time, add the following to the global parameter file:

ABETH_PLC_RESPONSE_TIMEOUT|1|<value>

where **<value>** is a positive integer.

For example,

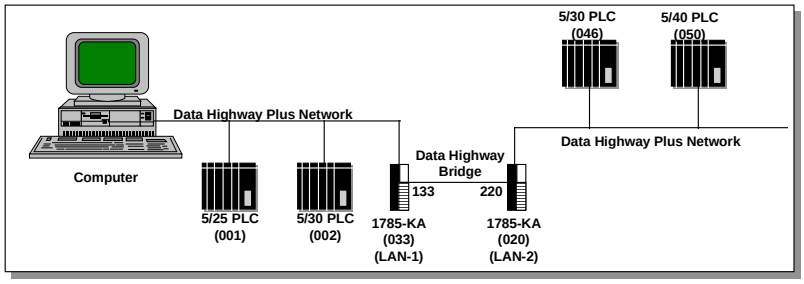
ABETH_PLC_RESPONSE_TIMEOUT|1|2

sets the wait time to 2 seconds.

Allen-Bradley Data Highway Plus Communications

About Allen-Bradley Data Highway Plus Communications

The Allen-Bradley Data Highway Plus Communications enabler utilizes a 1784-KT/B card to communicate with Allen-Bradley PLCs on a Data Highway Plus network.



Warning

Because of a registry conflict between the Allen-Bradley Data Highway Plus Communications enabler and RSLinx software, you cannot use the Allen-Bradley Data High Plus Communications enabler and the Allen-Bradley Communications enabler on the same computer.

Using this option, CIMPLICITY software can:

- Poll points at a user-defined scan rate or on demand.
- Read and write single points or arrays.
- Perform Engineering Unit conversion for meaningful point value displays.
- Issue alarms to users when a device goes down.

This communications interface can:

- Support up to six (6) 1784-KT/B cards in one PC.
- Access PLCs via a 1785-KA Bridge using off-link addressing.
- Receive unsolicited data messages from a PLC-3, PLC-5, or PLC-5/250 at a local or off-link address.

Note

This communications option does ***not*** support the 1784-KTX card. If you intend to use a 1784-KTX card, use the CIMPLICITY Allen-Bradley Communications option and Allen-Bradley RSLinx software.

This enabler supports the following CIMPLICITY HMI features:

- Polled read at user defined rates
- Poll after setpoint
- Triggered reads
- Unsolicited data
- Analog deadband
- Engineering units conversion
- Alarm on communications failure
- Server redundancy configuration

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Supported Allen-Bradley Data Highway Plus Devices

The Data Highway Plus communications enabler supports the following devices

- Allen-Bradley PLC-2®
- Allen-Bradley PLC-3®
- Allen-Bradley PLC-5 Family, excluding the PLC-502
- Allen-Bradley PLC-5/250™ (Pyramid Integrator)
- Allen-Bradley SLC 5/04

Supported PLCs may be accessed locally or via a 1785-KA Bridge using off-link addressing.

PLC-2 and PLC-3 devices must be in "RUN" mode for the Data Highway Plus Interface to communicate successfully with them.

The Data Highway Plus communications enabler also supports receipt of unsolicited data messages from the PLC-3, PLC-5, or PLC-5/250 at a local or off-link address. See the Data Highway Plus Unsolicited Data section for more information.

Data Highway Plus Supported File Types

PLC-2 File Types

For PLC-2, data can be read from and written to:

- Register Memory

PLC-3, PLC-5 and PLC-5/250 File Types

For PLC-3, PLC-5, and PLC-5/250, data can be read from and written to the following file types:

Type	Description
N	Integer
I	Input
O	Output
F	Floating Point Only FLOATING point types should be configured for the Floating Point (F) file type.
B	Bit
T	Timer
C	Counter

SLC 5/04 File Types

For SLC 5/04, data can be read from and written to the following file types:

Type	Description
N	Integer
B	Bit
T	Timer
C	Counter

Data Highway Plus Related Documents

You should have the following documentation available when configuring this interface option:

Allen-Bradley Cat. No. 1784-KT/B Installation Data Communication Interface Module

This document is shipped with each KT card and discusses the issues involved in selecting the interrupt (IRQ) and start/end controller addresses for use in a PC.

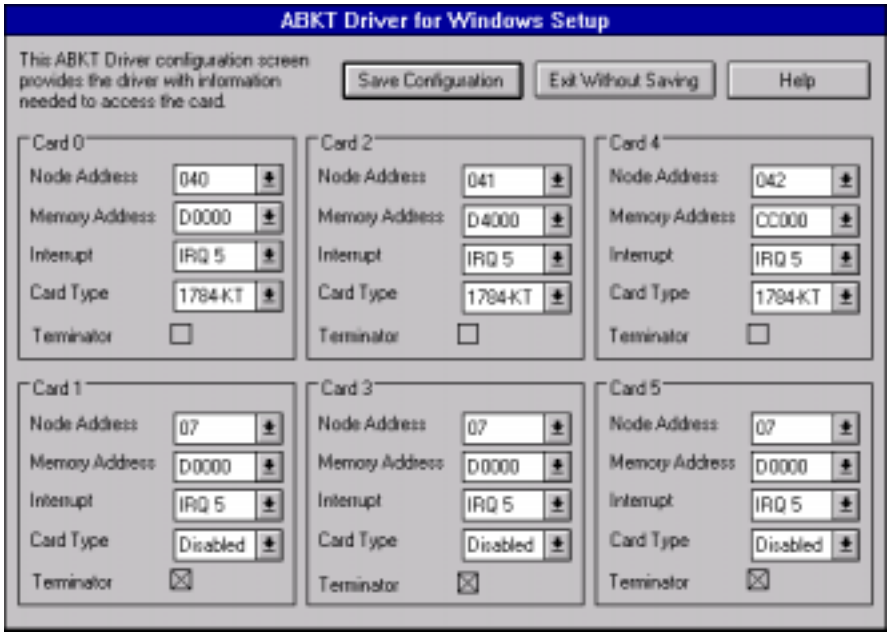
Data Highway Plus KT Card Configuration

The KT Card Configuration program is a program provided with the Data Highway Plus communication enabler that can be used to configure up to six KT cards on a PC.

For the KT Card Configuration program to successfully function, CIMPLICITY HMI software's Data Highway Plus communications enabler must be successfully installed, and the Data Highway Plus port(s) and devices must have been configured using CIMPLICITY application configuration functions.

To start the card configuration program, select the *KT Card Configuration* icon in the CIMPLICITY HMI menu.

The *ABKT Driver for Windows Setup* dialog box opens.



You may install up to six KT cards (numbered 0 through 5) in a PC. The following information must be configured for each KT card that you install:

Node Address Enter the node address of the KT card. The node address for each KT card must be a unique octal address between 00 and 77. Click the drop-down list to the right of the input field, and select the node address for the card from the choices given.

Memory Address Enter a unique starting memory address in shared memory on the PC for the KT card. This address is based on the hardware configuration of the computer and the hardware configuration option on the KT card.

A KT card uses 0x4000 bytes, or 16 KB, of memory for each card installed, and each KT card installed in a single PC must have a unique starting memory address. Be sure that the address chosen does not conflict with other cards, such as Ethernet interface cards.

Important

Under some circumstances, the Data Highway Plus device communication enabler cannot be reliably used in systems that use external memory caching hardware. If external memory caching is used, you must be able to *not* cache the shared memory addresses used by the KT cards. The device communication enabler and test program may fail to operate correctly if this is not done.

Interrupt Enter the interrupt (IRQ) to be used for the KT card. This number is based on the hardware configuration of the computer and the hardware configuration option of the KT card(s).

You must configure the same interrupt (IRQ) for all KT cards installed on a single PC within CIMPLICITY software.

Card Type Select the KT card type. Currently, the only valid choices are **1784-KT** or **Disabled**.

Terminator If the KT card is at the physical end of the Data Highway Plus network, set this check box to enable the software terminating resistor. If the card is *not* at the end of the network, clear this check box.

Select **Save Configuration** to save the configuration changes, or select **Exit Without Saving** to exit the utility without saving any changes.

After the changes are saved, the registry enables the configured ports at bootup.

To verify that the KT card(s) are operating correctly, use the diagnostic program. See the Data Highway Plus Installation Verification section for more information.

Special Note on I/O Cards

Problems have been reported following installation of some communication cards into some 486 and Pentium computers and other computers equipped with PCI and ISA interface bus slots. The Allen-Bradley 1784-KT card, and many Ethernet interface cards, use memory mapped I/O which by default is often not available in PCI/ISA bus computers.

Symptoms of this problem are seen when a driver attempts to access the I/O space of the card and all the driver sees is a mirror of the system main memory. This problem can become even more confusing when reads from the card I/O work, but I/O writes fail to produce the intended results.

Basically, the PCI/ISA controller maps computer system memory over the ISA memory address space. The BIOS setup usually has allocation features to allow access of memory mapped I/O and interrupts.

Different computers and BIOS setups use different terms to describe the memory mapping. Often memory mapped I/O is referred to as "Shared Memory" (not to be confused with inter-program shared memory on UNIX machines).

From within the computer BIOS setup, look for terms such as PCI Configuration or ISA Bus Setup. Typically, a memory configuration menu allows a block of memory, such as 64 KB starting at address D000:0000, to be selected. Simply configure the ISA bus cards and drivers to use memory within the configured window.

For example, on the Gateway P60 system, an ISA Shared Memory block may be enabled. The menu choice starts the address space at C8000, and a single range of 32 KB, 64 KB, or 96 KB may be selected. To install a 16 KB memory mapped Ethernet card, select the 64 KB range and place the Ethernet card at address D0000. Addresses C8000-CFFFF and D4000-D7FFF will still be available.

Data Highway Plus Installation Verification

The Data Highway Plus Diagnostic Program is a program provided with the Data Highway Plus communication enabler that you can use to check the basic configuration and operation of a network without starting CIMPLICITY HMI software.

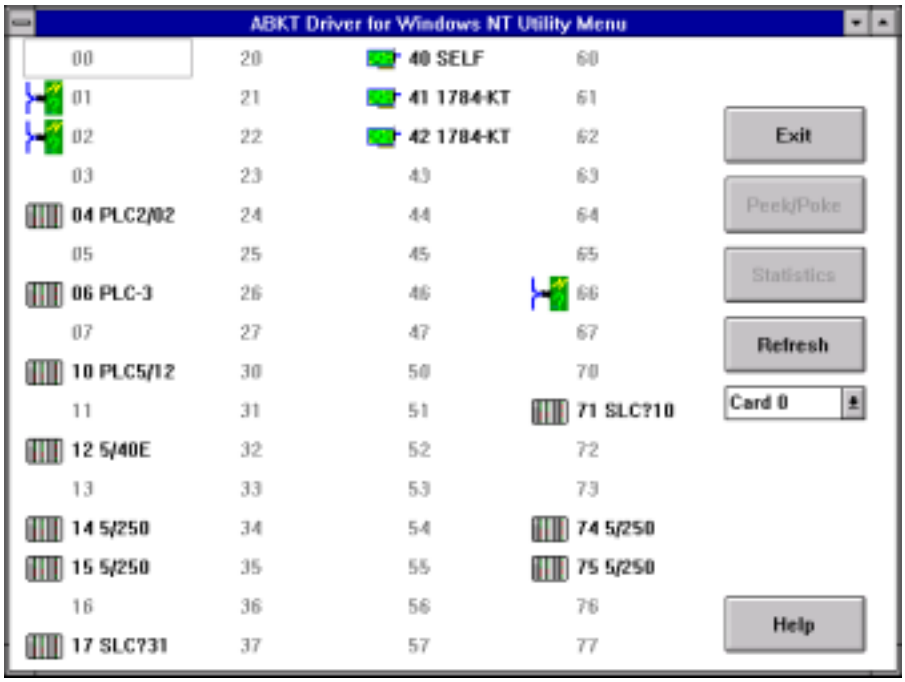
You can perform the following functions:

- Updates of the currently displayed file type
- Read test
- Write test

For this program to function, CIMPLICITY HMI software's Data Highway Plus communication enabler must be successfully installed, and the Data Highway Plus port(s) and devices must be configured using CIMPLICITY HMI application configuration functions.

To start the installation verification program, select the *DH+ Diagnostics* icon in the CIMPLICITY HMI menu.

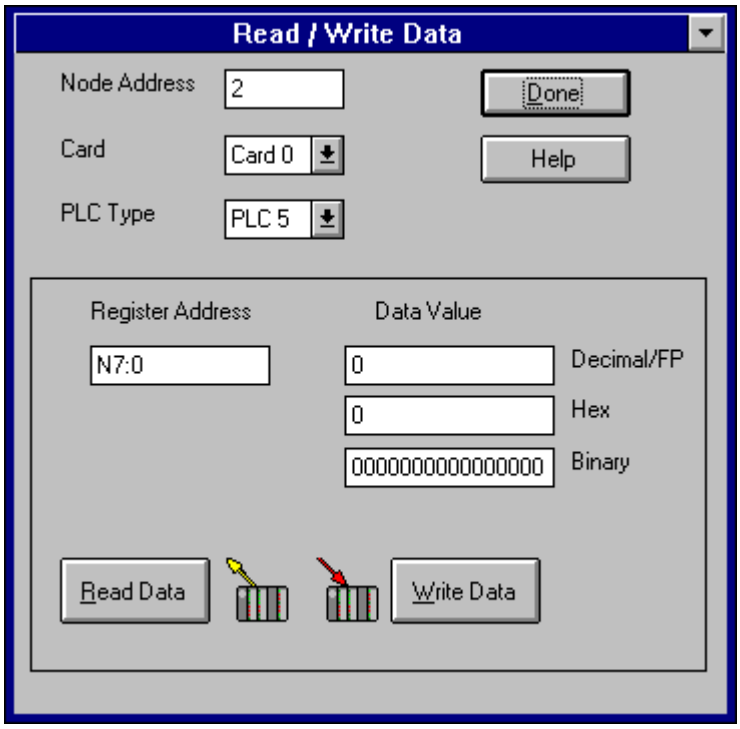
The *ABKT Driver for Windows NT Utility Menu* window opens.



When the program starts, the link communications monitoring menu displays. This menu monitors data communications and displays the active nodes on the network. Each active node address has an icon displayed next to it, which indicates whether the device is a PLC, Bridge, or KT card. If the device is a PLC, the model number is also displayed. If communications to a node are lost, the icon is displayed dim and cannot be selected.

Reading and Writing Data Highway Plus Test Data

When you select a PLC, the *Read/Write Data* dialog box opens.



The node address and KT card number used by the PLC are displayed at the top of the dialog box.

To read data, enter a valid address in the **Register Address** field and select **Read Data**. The current contents of the address are displayed in the **Data Value** fields in decimal, hexadecimal, and binary format.

To write data, enter a valid address in the **Register Address** field, and a valid value in one of the **Data Value** fields, then select **Write Data**.

To select another PLC for testing, enter its node number in the **Node Address** field.

Data Highway Plus Application Configuration

When configuring ports, devices, and points that use the Data Highway Plus Communication enabler, some fields must contain unique values for the communications to work successfully. These are detailed below.

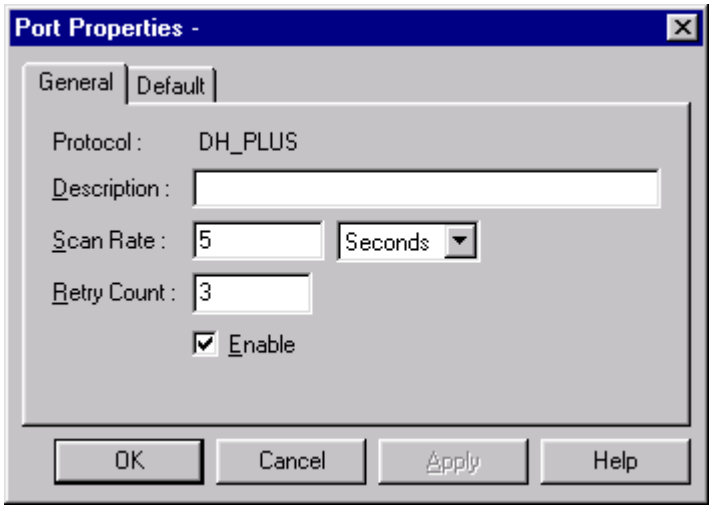
Port Configuration

When you configure a port for Data Highway Plus Communications, enter the following in the *New Port* dialog box:

1. In the **Protocol** field, select **DH_PLUS** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for Allen-Bradley Data Highway Plus Communications.

When you select **OK**, the *Port Properties* dialog for the protocol opens.

General Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description Enter an optional description to help identify the port.

Scan Rate Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

You can specify the scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.

Enable Set this check box if the port is to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Default Properties

The *Default* properties are not used for Data Highway Plus communications.

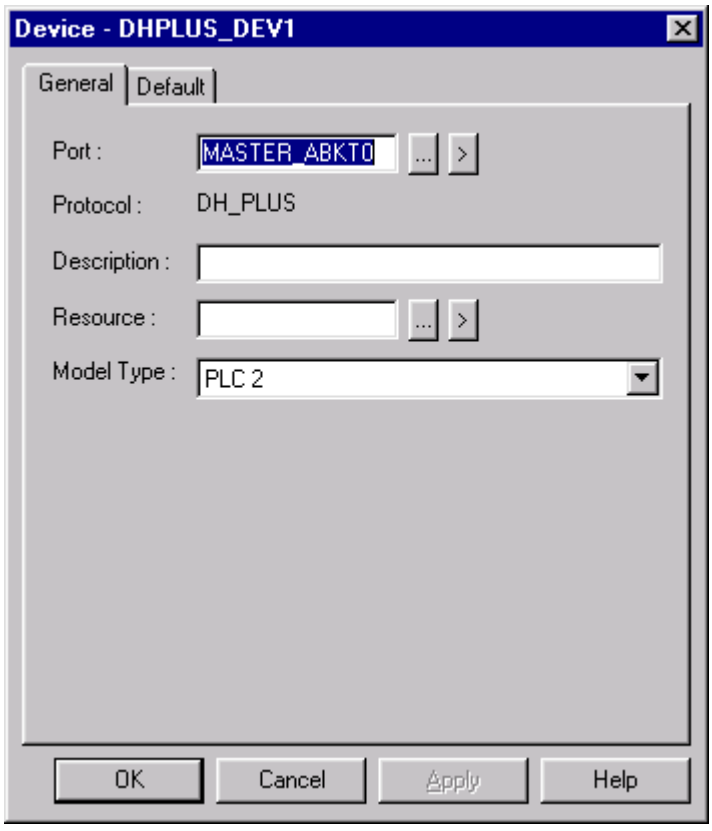
Data Highway Plus Device Configuration

When you configure a device for Allen-Bradley Data Highway Plus Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Allen-Bradley Data Highway Plus Communications port to be used for the device.

When you select **OK**, the *Device Properties* dialog box for devices using this protocol opens.

General Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help identify the device.

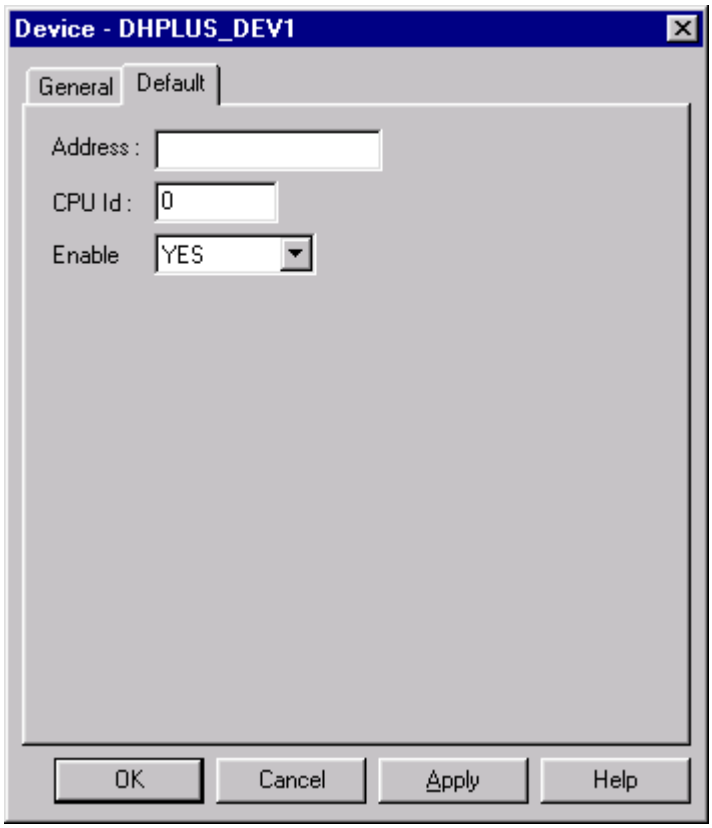
Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button - - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For Data Highway Plus, the choices are:

PLC 2	**PLC 5/250**
PLC 3	**SLC 5/04**
PLC 5	

Default Properties



Use the *Default* properties to enter information about Data Highway Plus communications for the device. You can define the following:

Address Enter the node ID for the device.

For a local node, this is the octal node address (a value between 00 and 77) of the PLC.

For remote communications through a 1785-KA bridge, this is an address consisting of three fields as follows:

`<local_node_no>.<network_no>.<remote_node_no>`

In our Sample Data Highway Plus Network, the Address for the 5/25 PLC is "1" and the Address for the 5/40 PLC is "33.2.50".

CPU ID *Not used.*

Enable Select **Yes** to enable the device when the project starts. Select **No** to disable the device. If you select **No**, the device will not be enabled at startup and points associated with the device will be unavailable.

Point Configuration

When defining a point, the following fields have values that are unique to or have special meaning for Data Highway Plus communications.

General Page

On the *General* page, you may configure points for **Read** or **Read/Write** access.

Device Page

On the *Device* page, you may configure:

Address

Point address requirements are device-dependent. Valid device types are:

PLC-2
PLC-3
PLC-5
PLC-5/250
SLC 5/04

See the sections below for detailed information on the point address requirements for each device type.

Update Criteria

The update criteria determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by the Allen-Bradley Data Highway Plus Communications enabler at regular intervals.

Select **On Demand On Change** or **on Demand on Scan** for points whose values should be polled by the Allen-Bradley Data Highway Plus Communications enabler at regular intervals while users are displaying them.

Select **Unsolicited** for points whose value will be sent by a PLC-3, PLC-5, or PLC-5/250 as necessary.

Remember that unsolicited data is only supported on the PLC-3, PLC-5, and PLC-5/250.

When configuring Boolean points, you must also enter data in the following field:

Bit Offset

Enter the bit offset that corresponds to the bit position within the word.

The valid range for bit offset is 0 - 15, where 0 is the least significant bit. The bit offset must be specified as a decimal value.

When defining points for reading or writing data between CIMPLICITY HMI software and a Floating Point (F) file, use the **Real** data structure type.

When configuring array points, make sure that the size of the array is within the limits of the file. CIMPLICITY HMI software does not declare an array configured beyond the end of a file as invalid. If an array point is configured that extends beyond the end of a file, a $DEVICE_DOWN alarm will be generated each time an attempt is made to read data from or write data to the point.

Point Address Formats

PLC-2 Address Formats

PLC-2 devices support the following address formats:

File Type	Address Format
R	**<ELEMENT>** where **<ELEMENT>** is an octal offset.

PLC-3 Address Formats

PLC-3 devices support the following address formats:

File Type	Address Format
N, F, B	**<FILE><FILE NUMBER>:<ELEMENT>** The use of leading zeros when specifying the **<FILE NUMBER>** and the **<ELEMENT>** is *not* supported.
I, O	**<FILE><FILE NUMBER>:<OFFSET>** where **<FILE>** is **I** for inputs or **O** for outputs, and **<OFFSET>** is an octal offset.
T, C	**<FILE><FILE NUMBER>.<TYPE>** where **<FILE>** is **T** for timers or **C** for counters, and **<TYPE>** is one of the following: ACC - Accumulator PRE - Preset CTL - Control Word Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	**Offset**	**Control Bit**	**Offset**
CU	15	TE	15
CD	14	TT	14
DN	13	TD	13
OV	12		
UF	11		
EN	10		
ZR	9		
FN	8		

PLC-5 Address Formats

PLC-5 devices support the following address formats:

File Type	Address Format
N, F, B	**<FILE><FILE NUMBER>:<ELEMENT>** The use of leading zeros when specifying the **<FILE NUMBER>** and the **<ELEMENT>** is *not* supported.
I, O	**<FILE>:<OFFSET>** where **<FILE>** is **I** for inputs or **O** for outputs, and **<OFFSET>** is an octal offset.
T, C	**<FILE><FILE NUMBER>:<ELEMENT>.<TYPE>** where **<FILE>** is **T** for timers or **C** for counters, and **<TYPE>** is one of the following: ACC - Accumulator PRE - Preset CTL - Control Word Accumulators, Presets, and Control Words are 16 bits. Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	**Offset**	**Control Bit**	**Offset**
CU	15	EN	15
CD	14	TT	14
DN	13	DN	13
OV	12		
UN	11		

PLC-5/250 Address Formats

PLC-5/250 devices support the following address formats:

File Type	Address Format
N, F, B	**<MODULE><FILE><FILE NUMBER>:<ELEMENT>** The use of leading zeros when specifying the **<FILE NUMBER>** and the **<ELEMENT>** is *not* supported.
I, O	**<FILE>:<OFFSET>** where **<FILE>** is **I** for inputs or **O** for outputs, and **<OFFSET>** is an octal offset.
T, C	**<MODULE><FILE><FILE NUMBER>:<ELEMENT>.<TYPE>** where **<FILE>** is **T** for timers or **C** for counters, and **<TYPE>** is one of the following: ACC - Accumulator PRE - Preset CTL - Control Word Accumulators and Presets are 32 bits. Control Words are 16 bits and are *read-only*. Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	**Offset**	**Control Bit**	**Offset**
CU	15	EN	15
CD	14	TT	14
DN	13	DN	13
OV	12		
UN	11		

SLC 5/04 Address Formats

SLC 5/04 devices support the following address formats:

File Type	Address Format
N, B	**<FILE><FILE NUMBER>:<ELEMENT>** The use of leading zeros when specifying the **<FILE NUMBER>** and the **<ELEMENT>** is *not* supported.
T, C	**<FILE><FILE NUMBER>:<ELEMENT>.<TYPE>** where **<FILE>** is **T** for timers or **C** for counters, and **<TYPE>** is one of the following: ACC - Accumulator PRE - Preset CTL - Control Word Accumulators, Presets and Control Words are 16 bits. Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	**Offset**	**Control Bit**	**Offset**
CU	15	EN	15
CD	14	TT	14
DN	13	DN	13
OV	12		
UN	11		

Note on PLC-5 Addressing

CIMPLICITY software uses different addressing from Allen-Bradley. To use Allen-Bradley addressing, enter the following record in the global parameters file:

```
ABKT_AB_ADDRESSING|1|<flag>
```

If **<flag>** is set to **TRUE**, then for PLC-5 devices:

1. I and O points offsets are in octal.
2. DN, TT, and EN are valid suffixes for T points.
3. B address can be specified as absolute bit number instead of word number and bit offset for digital points.

To use CIMPLICITY addressing, set **<flag>** to **FALSE** or remove the record from the global parameters file.

Data Highway Plus Unsolicited Data

The Data Highway Plus communication enabler supports the receipt of unsolicited data from the PLC-3, PLC-5 and PLC-5/250 to CIMPLICITY software *only*. The maximum message size is 1000 bytes.

CIMPLICITY device points are updated by an unsolicited data message if the following criteria are true:

- The point length in bytes is less than or equal to the data length that is transmitted in the message
- The Data Highway address of the device configured for the point matches that of the sending device.
- The configured point address, except for Timers and Counters, matches the External Data table Address exactly.

For Timers and Counters, it is not possible to specify an element type (ACC, PRE, or CTL). Therefore, when Timer or Counter data is sent, the data is stored in the CIMPLICITY point or points whose address matches the External Data Table Address, excluding the type. For example, if T4:0 is sent from the PLC and points for T4:0.CTL, T4:0.PRE, and T4:0.ACC have been defined in CIMPLICITY software for the device, then all three points are updated with the T4:0 data each time a valid unsolicited message is received from the device.

Unsolicited Data Message Block

The message block must specify the following information:

Communication command	PLC-5: Typed Write. PLC-3: Word Range Write, Logical Address
Internal data address	Starting address in the PLC of the data.
Number of elements	Number of elements of data.
Local/Remote	Use LOCAL for local connections, or REMOTE for connections via a bridge.
Remote Station *	If REMOTE was selected, enter the network address of the KT card. This address consists of the elements: **<LAN><KT card network address>**
Link ID *	0 (zero).
Remote link type *	If REMOTE was selected, enter "Data Highway".
Local node address	If REMOTE was selected, enter the address of the bridge local to the PLC sending data.
External data table address	Data address configured for the CIMPLICITY point. For example, if N1:0 is the address configured for the point, then N1:0 should be specified. The address configured here must match the configured CIMPLICITY point address exactly (see following note for Timers and Counters).

* This information is needed only when REMOTE is entered in the Local/Remote field.

PLC-5 Example

The following sample message blocks show you how to send messages from Allen-Bradley PLC-5 to CIMPLICITY software. Also included is a sample ladder diagram for multiple messages.

Sample PLC-5 Unsolicited Message Block

For example, in the sample network, to send 3 elements starting at N7:0 from the PLC-5/30 to CIMPLICITY software, the message command would be:

```
Communications command          PLC-5 Typed Write
Internal data address:          N7:0
Elements:                       3
Local/Remote:                   REMOTE
Remote Station                  176   (LAN 1, address 76)
Link ID:                        0
Remote link type:               Data Highway
Local node address              20
External data table address:    N7:0
```

In CIMPLICITY software, if an INT type array point of 3 elements starting at N7:0 and a scan type of UNSOLICITED is defined for the device sending the unsolicited data point, values are updated each time the message is received from the PLC-5/30.

Sample PLC-5 Message Block For Timers

In the sample network, to send an unsolicited TIMER from the PLC-5/40 (050) to CIMPLICITY software, configure the following CIMPLICITY information:

1. A device corresponding to the PLC 5/20 whose station address is 33.2.50, and model is PLC-5.
2. Configure the following three points:

   T4:0.ACC as data structure type INT

   T4:0.PRE as data structure type INT

   T4:0.CTL as data structure type UINT

On the PLC-5/40, the message command is:

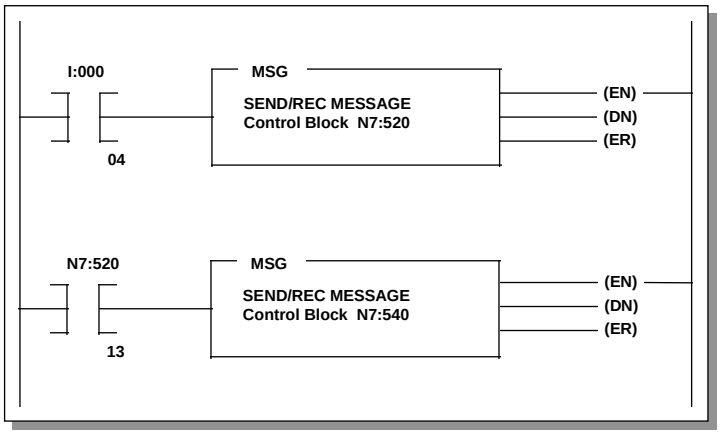
```
Communications command          PLC-5 Typed Write
Internal data address:          T4:0
Elements:                       1
Local/Remote:                   REMOTE
Remote Station                  176   (LAN 1, address 76)
Link ID:                        0
Remote link type:               Data Highway
Local node address              20
External data table address:    T4:0
```

It is absolutely necessary that the address of the unsolicited data be defined using only capital letters. CIMPLICITY software needs to exactly match an incoming address, and addresses are decoded into upper-case only.

In addition, unsolicited data packets are not encoded with leading zero information. An address such as N7:01 will read correctly, but an unsolicited packet will encode this incoming address as N7:1. These addresses are matched and the data will not be received.

Sample PLC-5 Ladder Diagram for Multiple Messages

Be aware that both PLC-5 and PLC-5/250 processors can interleave communications packets. The Data Highway Plus device communication enabler can only process one message for each node at a time. If two messages are sent from a single node, both messages being larger than 220 words, the data may be inadvertently interleaved. A solution is to trigger a second message upon completion of a first message. For example:



PLC-3 Unsolicited Messages

For detailed information of the Unsolicited Message format, refer to the Allen-Bradley PLC-3 SR5 documentation, ***PLC-3 Family I/O Scanner Communication-Adapter Module***. The following examples should aid you in configuring unsolicited packets for CIMPLICITY software.

All the lengths in the messages are represented in words. This works well for 16 bit values such as N, B, and other 16 bit elements. However there are special cases for Float, Timer, and Counter elements.

- F registers should always be sent in double word increments. A single float is 2 words, 5 F registers are 10 words.
- Timers and counters are sent as the complete timer/counter control structure. Each of these structures contains 5 words. Be sure to multiply the number of timers times five words.

Important

The CIMPLICITY node *cannot* be node 77 (octal) on the network for the PLC 3 to be able to send unsolicited data to it. The address 77 implies special meaning to the 1775 SR-5 interface.

A 200 word unsolicited N7:50 to CIMPLICITY as node 50

The command message in ladder logic to send a 200 word unsolicited message to CIMPLICITY software from N7:50.

```
MESSAGE TYPE 1
CTL=B150.0
CH=E2.3.1
#H050$N7:50=$N7:50
```

where:

B150:0	Bit space to configure the message
E2.3.1	Specific depending on the interface module. This is the correct value for a 1775-SR5
#H050$N7:50=$N7:50	The message can be decoded as follows:
	#H050 Indicates the destination node as 050 (octal).
	$N7:50 The destination address at node 050
	=$N7:50 Source of the data.

Note that destination address must exist on the PLC-3. During startup, the PLC-3 is interrogated for each address.

Example Using Floating Point Data

This message sends 10 floats, 2 words each.

```
MESSAGE TYPE 1
CTL=B150.200
CH=E2.3.1
#H050$F3:0=$F3:0,20
```

Example using Timers

This message sends 5 timers, at 3 words each.

```
MESSAGE TYPE 1
CTL=B150.400
CH=E2.3.1
#H050$T1=$T1,15
```

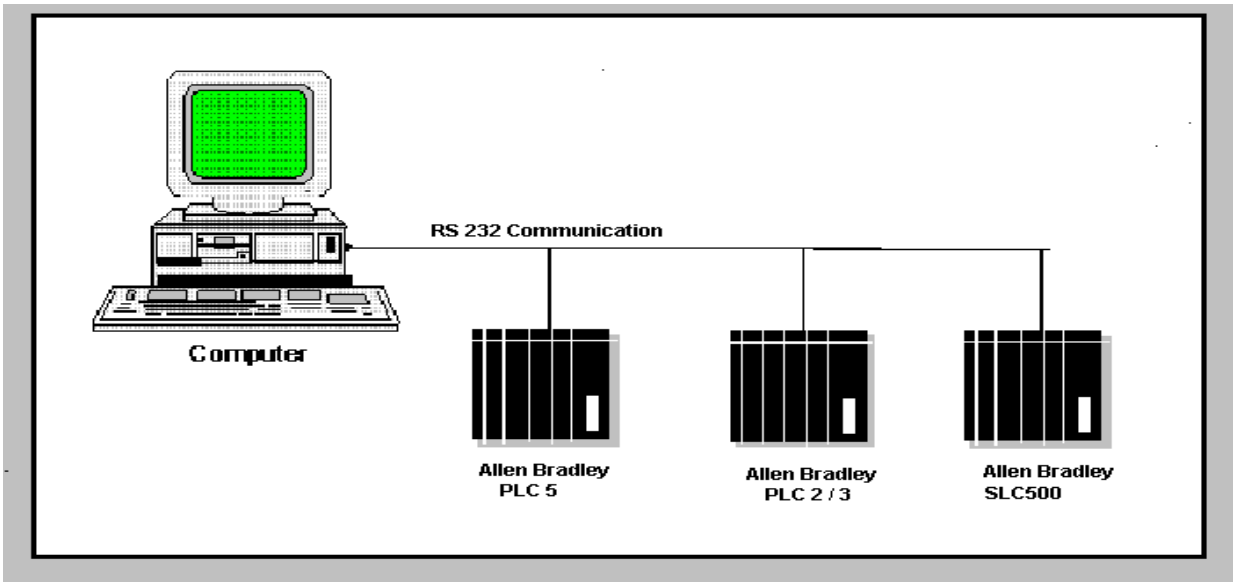
Allen-Bradley DF-1

About Allen-Bradley DF-1

The CIMPLICITY Allen-Bradley DF-1 Communication Enabler can be used to communicate with Allen-Bradley Programmable Controllers through the DF-1 serial communication protocol.

Using this option, CIMPLICITY software can:

- Poll points at a user-defined scan rate or on demand.
- Read and write single points or arrays.
- Perform Engineering Unit conversion for meaningful point value displays
- Issue alarms to user when a device goes down.



Allen-Bradley DF-1 Supported Devices

This communication enabler supports the following Allen-Bradley Programmable Controllers:

- PLC 2 / PLC 3.
- PLC 5
- SLC 500 Series.

Allen-Bradley DF-1 Supported Memory Types

Data may be read and written to the following memory types.

- Analog Inputs
- Analog Outputs
- Integer Files
- Timers
- Counters
- Bits
- Status Registers
- Files

Allen-Bradley DF-1 Application Configuration

When configuring ports, devices, and points that use the DF-1 enabler, some fields must contain unique values for the communications to work successfully. These are detailed below.

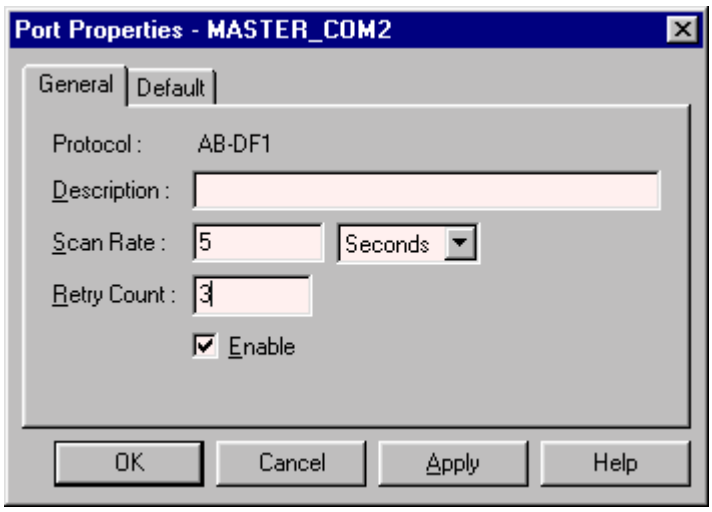
Port Configuration

When you configure a port for DF-1, enter the following in the *New Port* dialog box:

1. In the Protocol field, select AB-DF-1 from the list of available protocols.
2. In the Port field, select the communication port that will be used for the Allen-Bradley DF-1 enabler.

When you select **OK**, the Port Properties dialog for the protocol opens.

Allen Bradley DF-1 General Port Properties



Use the General tab of the Port Properties dialog box to enter general information for the port. You can define the following:

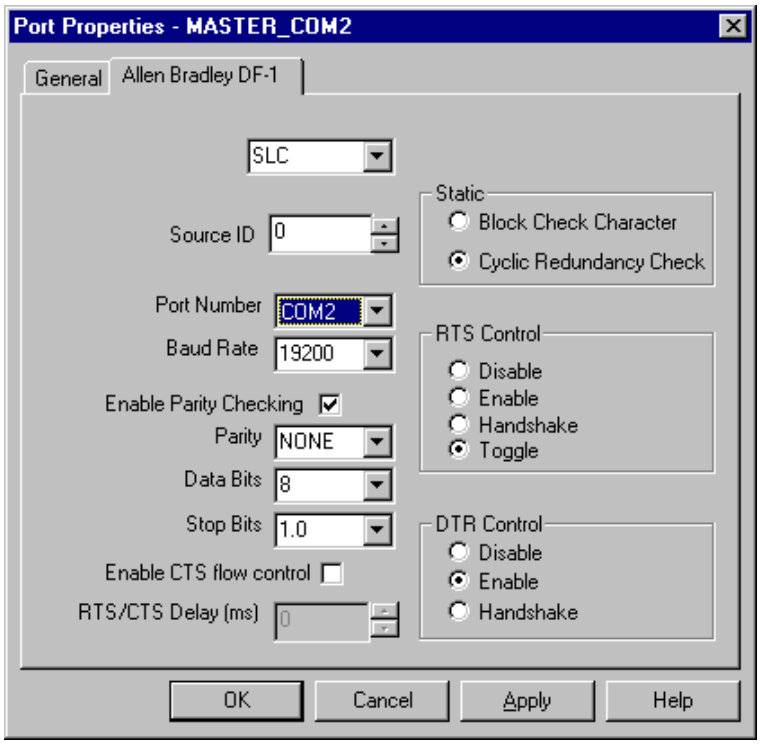
Description — Enter an optional description to help identify the port

Scan Rate — Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify the scan rate in Ticks (100 ticks = 1 second), Seconds, Minutes, or Hours.

Retry Count — If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it. Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.

Enable — Set this check box if the port is to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Allen Bradley DF-1 Port Properties



Use the Allen Bradley DF-1 tab of the Port Properties dialog box properties to enter Allen Bradley DF-1 protocol information for the port. You can also define these settings using the independent test utility. In the Allen Bradley DF-1 properties dialog box you can define the following:

Source ID	Enter station number of the DF-1 device.
Port Number	Select COM port connected to the device**.**
Baud rate	Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.
Parity	Select the parity to be used for communications.
Data Bits	Select the number of data bits from the drop out box**.**
Stop Bits	Number of stop bits**.**
Error Type	Can be a Block Check character (BCC) type or Cyclic Redundancy Check (CRC) type.
RTS Control	Default is **Toggle.**
DTR Control	Default is **Enable**

These settings will override those from the independent test utility. *See the "DF-1 Setup Utility" section in this chapter for a description of the setup utility.*

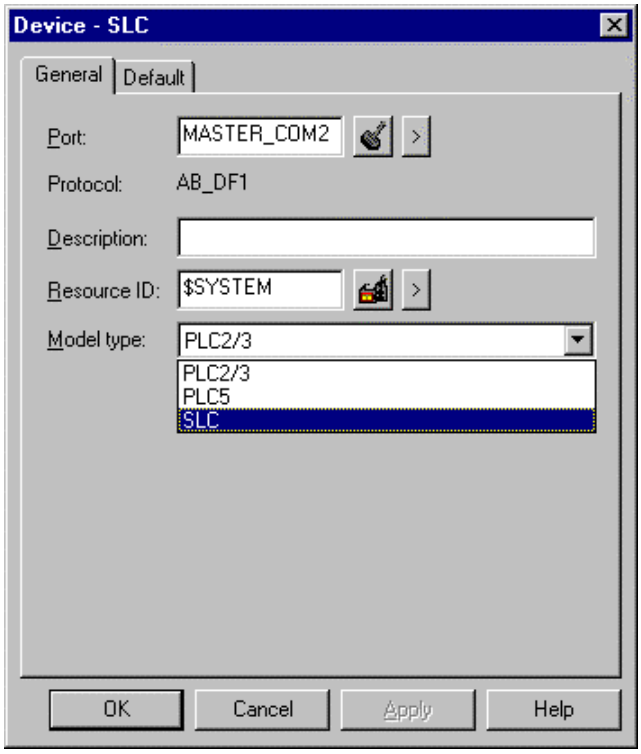
DF-1 Device Configuration

When you configure a device for the DF-1 enabler, enter the following information in the New Device dialog box:

1. In the Device field, enter the name of the device you are configuring.
2. In the Port field, select the Serial Communications port to be used for the device.

When you click **OK**, the Device Properties dialog box for devices using this protocol opens.

Allen Bradley DF-1 General Device Properties



Use the General tab of the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device. You can click the Browse button to the right of the field to display the list of ports and select one. You can click the Pop-up Menu button to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help identify the device

Resource

Enter a resource that can be associated with this device.

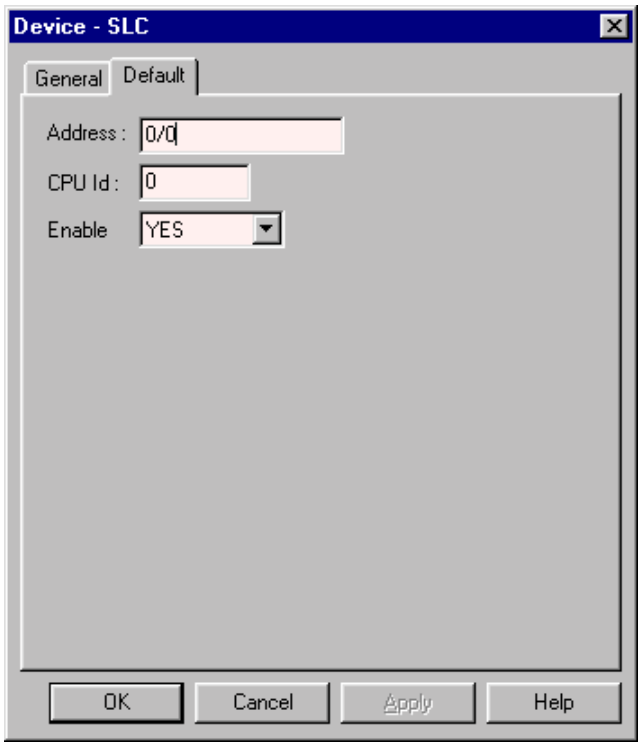
You can click the Browser button to the right of the field to display the list of resources and select one. You can click the Pop-up Menu button to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type

Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For Allen-Bradley DF-1, the choices are:

PLC2/3
PLC5
SLC

Allen Bradley DF-1 Default Device Properties



Use the Default tab of the Device dialog box to enter information about DF-1 communications for the device. You can define the following:

Address

Enter the node ID for the device.

For PLC 2 or PLC 3 this is an optional Station Number Address used only when writing to a PLC 2 via a KA or KG module. If this field is not used, it should be set to zero.

For PLC 5 this is an address consisting of two fields as follows:

<Octal digit station address>/< Octal digit station address if the KF2 Module>

For SLC this is an address consisting of two fields as follow:

<PLC Network address (00-31)>/<KF3 Node address>

CPU ID

Not used.

Enable

Select “Yes” to enable the device when the project starts. Select “No” to disable the device. If you select “No”, the device will not be enabled at startup and points associated with the device will be unavailable.

Point Configuration

When defining a point, the following fields have values that are unique to or have special meaning for DF-1 communications.

General Point Properties

On the *General* tab of the *Point Properties* dialog box, you may configure points for **Read** or **Read/Write** access.

Device Point Properties

On the Device tab of the Point Properties dialog box, you may configure:

Address — Point address requirements are device-dependent. Valid device types are PLC2/3, PLC5, and SLC. See the sections below for detailed information on the point address requirements for each device type.

Update Criteria — The update criteria determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by the Allen-Bradley DF-1 Communications enabler at regular intervals.

When configuring Boolean points, you must also enter data in the following field:

Bit Offset — Enter the bit offset that corresponds to the bit position within the word.

The valid range for bit offset is 0 - 15, where 0 is the least significant bit. The bit offset must be specified as a decimal value.

When configuring array points, make sure that the size of the array is within the limits of the file. CIMPLICITY HMI software does not declare an array configured beyond the end of a file as invalid. If an array point is configured that extends beyond the end of a file, a $DEVICE_DOWN alarm will be generated each time an attempt is made to read data from or write data to the point.

PLC2 and PLC3 Address Format

PLC 2 and PLC 3 devices support the following address format:

File Type

<highway number> BN <element>

<highway number> B3 <element>

<highway number> B4 <element>

<highway number> BT <element>

where the Highway number is an octal number.

The file type is

BN for 16 bit Analog

B3 for 3 decade BCD

B4 for 4 decade BCD

BT driving out discrete values to PLC

The element is the internal address.

PLC 5 Address Format

PLC-5 devices support the following address formats:

File Type	Address Format
N, F, B	**<FILE><FILE NUMBER>:<ELEMENT>** The use of leading zeros when specifying the **<FILE NUMBER>** and the **<ELEMENT>** is not supported.
I, O, S	**<FILE>:< ELEMENT >** where **<FILE>** is **I** for inputs or **O** for outputs and **S** for status.
T, C	**<FILE><FILE NUMBER>:<ELEMENT>.<TYPE>** where **<FILE>** is **T** for timers or **C** for counters, and **<TYPE>** is one of the following: **ACC**–Accumulator **PRE**–Preset **CTL–**Control Word Accumulators, Presets, and Control Words are 16 bits. Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	**Offset**	**Control Bit**	**Offset**
CU	15	EN	15
CD	14	TT	14
DN	13	DN	13
OV	12		
UN	11		

SLC Address Format

SLC 5/04 devices support the following address formats:

File Type	Address Format
N, F, B	**<FILE><FILE NUMBER>:<ELEMENT>** The use of leading zeros when specifying the **<FILE NUMBER>** and the **<ELEMENT>** is not supported.
I, O, S	**<FILE>:< ELEMENT >** where <**FILE**> is **I** for inputs or **O** for outputs and **S** for status.
T, C	**<FILE><FILE NUMBER>:<ELEMENT>.<TYPE>** where **<FILE>** is T for timers or C for counters, and **<TYPE>** is one of the following: **ACC** – Accumulator **PRE** – Preset **CTL** - Control Word Accumulators, Presets and Control Words are 16 bits. Bit offsets for the Control Word (CTL) in Counters and Timers are:

Counters		Timers	
Control Bit	**Offset**	**Control Bit**	**Offset**
CU	15	EN	15
CD	14	TT	14
DN	13	DN	13
OV	12		
UN	11		

DF-1 Setup Utility

The DF-1 Setup Utility Program is a program provided with the Allen-Bradley DF-1 communication enabler that you can use to check the basic configuration and operation of the communication path without starting CIMPLICITY HMI software This test utility is normally installed in \CIMPLICITY\HMI\EXE directory.

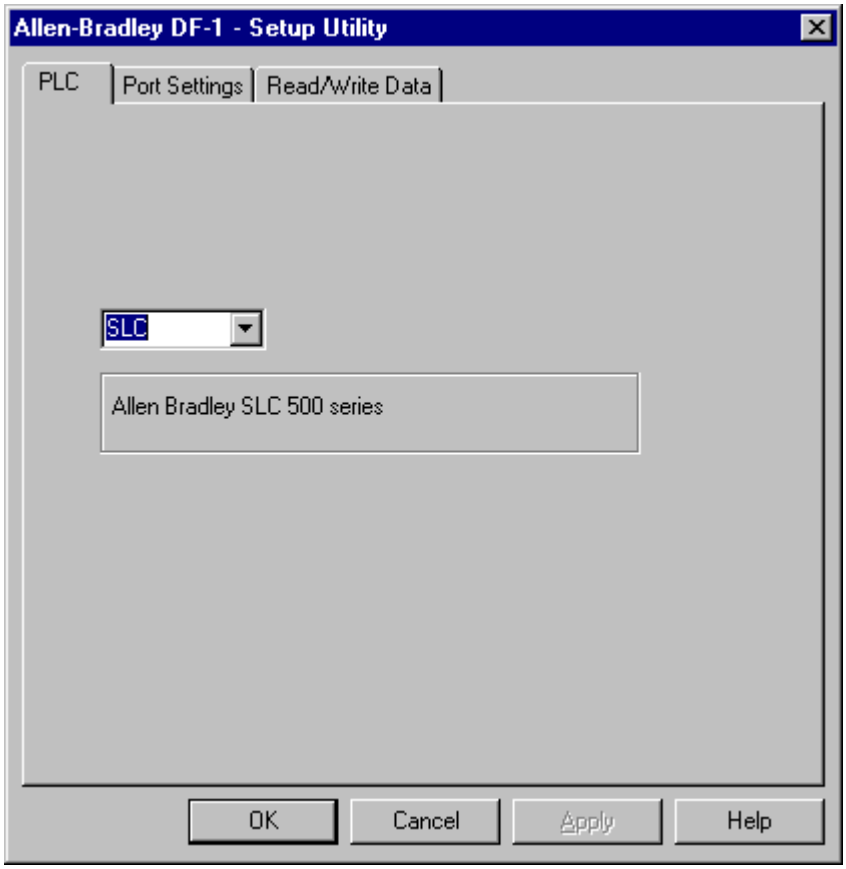
You can perform the following functions:

- Configure Advanced Port Settings
- Read test
- Write test

For this program to function, CIMPLICITY HMI software's Allen-Bradley DF-1 communication enabler must be successfully installed. To start the installation verification program, select the DF-1 Setup icon in the CIMPLICITY HMI menu.

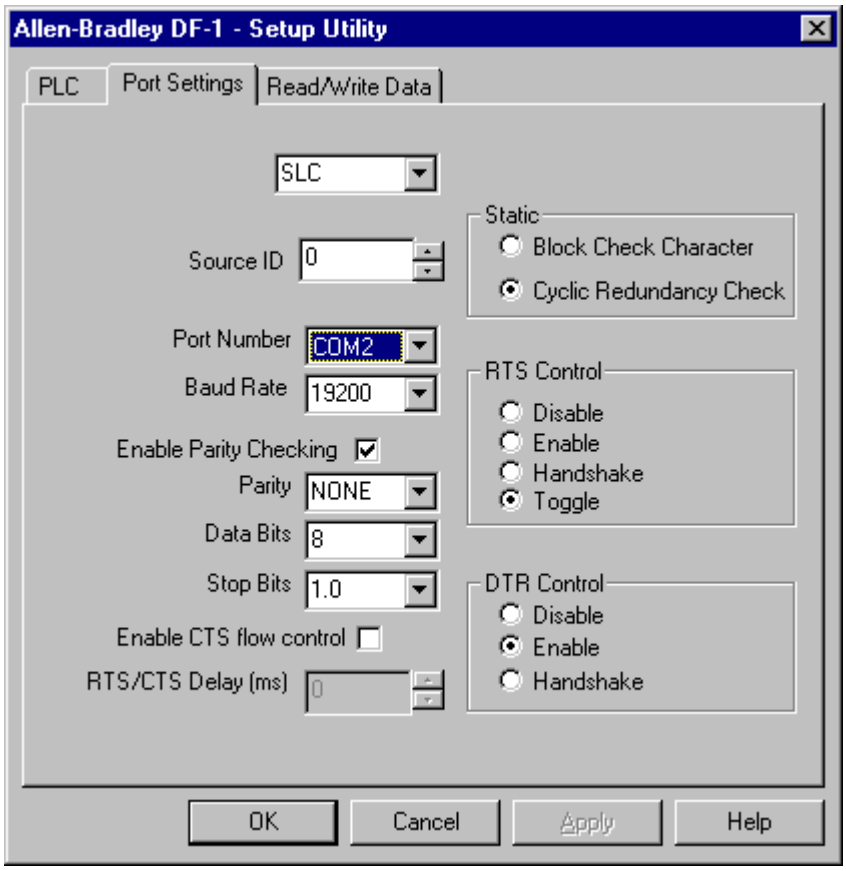
PLC Setup Utility Properties

When the program starts, you must select the Model type of PLC from the drop-down list box. The list is on the *PLC* tab of the *Setup Utility* dialog box.



Port Setting Setup Utility Properties

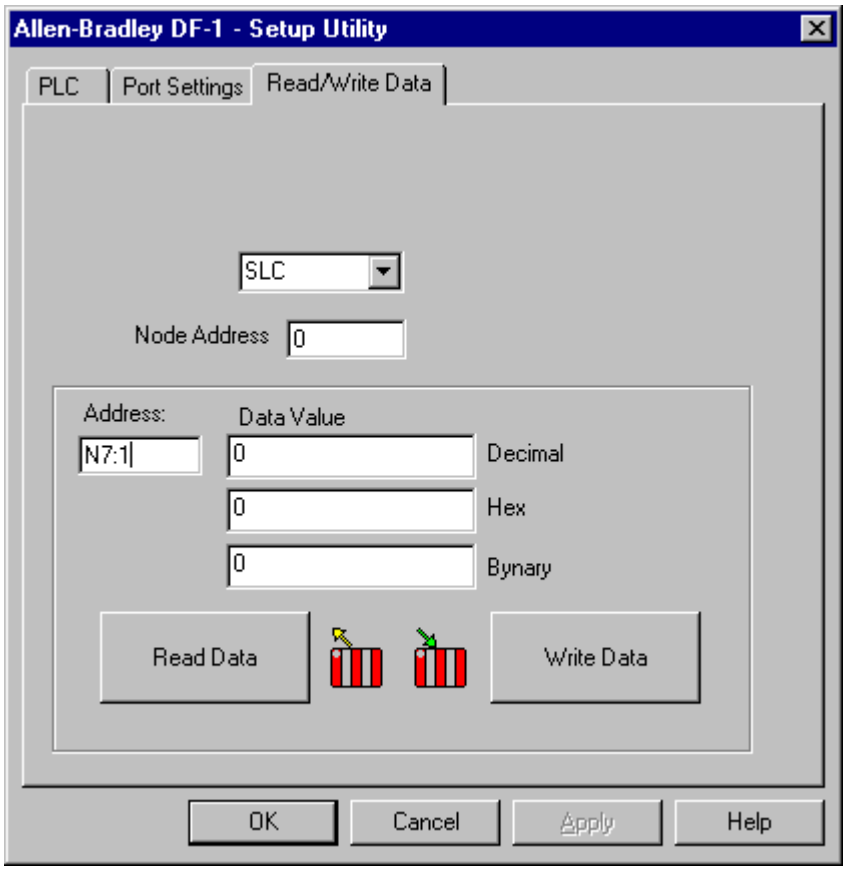
Use the field on the Port Settings tab of the Setup Utility dialog box, to configure the serial port characteristics:



Source ID	Enter the station number of the DF-1 device.
Port Number	Select the COM port attached to the device.
Baud rate	Enter the baud rate for communications from the drop-down list.
Parity	Select the parity to be used for communications.
Data Bits	Select the number of data bits in the data from the list.
Stop Bits	Number of stop bits.
Error Type	Can be a Block Check character (BCC) type or Cyclic Redundancy Check (CRC) type.
RTS Control	Default is **Toggle**.
DTR Control	Default is **Enable**.

Read/Write Data Setup Utility Properties

After configuring the port parameters the communication can be tested with the Read/Write Data tab of the Setup Utility dialog box.

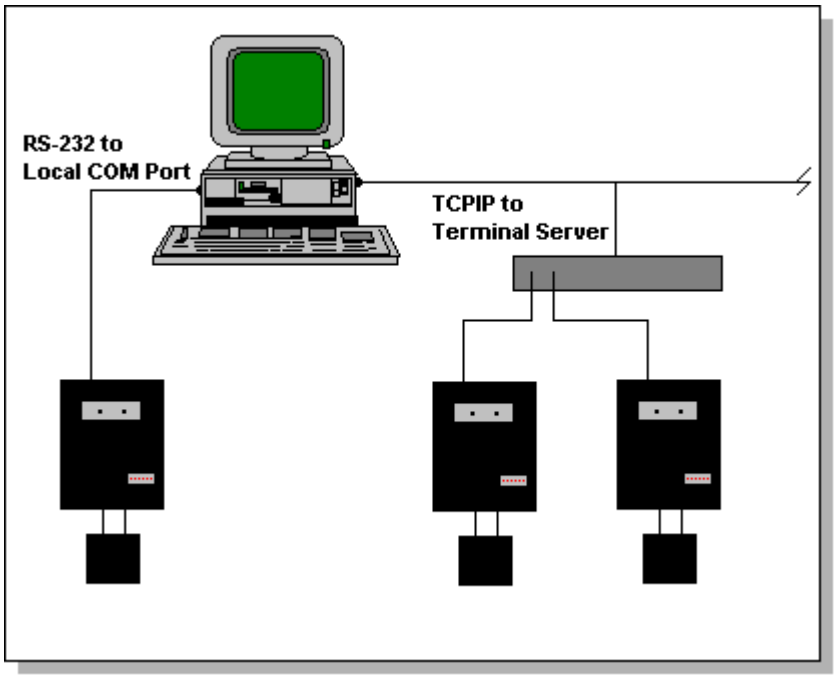


Node Address	Enter the same as the **Source ID** on the *Port Settings* tab.
Address	Enter the address to be tested.
Data Value	Enter data value in decimal to be written on the PLC.
Read Data	Reads data from the address specified in the *Address* field and updates the *Data Value* field.
Write Data	Writes the data from the *Data Value* field to the address in the *Address* field.
OK / Cancel	Closes the application.
Help	Provides the online help about the Setup utility.

Allen-Bradley Intelligent Antenna Communications

About Allen-Bradley Intelligent Antenna Communications

The Allen-Bradley Intelligent Antenna Communications enabler uses the computer's local serial ports, or a remote terminal server to communicate with Allen-Bradley Intelligent Antenna devices.



The Allen-Bradley 2750-AS series antenna is one component of a Radio Frequency Identification (RFID) system. Antennas collect information from RF tags attached to objects. There are three basic types of RF tags:

- Read Only Tags
- Read/Write Tags
- Programmable Tags.

The Allen-Bradley Intelligent Antenna Communications enabler supports read access to the byte addressable memory of the all three RF Tag types (2-8K bytes of data depending on model). It can also write to the Read/Write Tags and the Programmable Tags. The *Program Tag* transaction *is not* supported.

The Allen-Bradley Intelligent Antenna Communications enabler also supports the automatic download of antenna setup parameters during startup and re-establishment of communications. The setup parameters are configurable for each individual device (antenna).

Communications Enabler Features

Using this option, CIMPLICITY software can:

- Detect the presence of a Tag within the antenna's range
- Read Tag data at a user-defined scan rate
- Write data to the Tag
- Issue alarms to users when a read/write error occurs
- Monitor antenna configuration through diagnostic points

This enabler can:

- Support an infinite number of Intelligent Antennas in any combination of local serial ports and/or remote terminal servers.

This enabler supports the following CIMPLICITY HMI features:

- Polled read at user defined rates
- Poll after setpoint
- Triggered reads
- Alarm on communications failure

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Allen-Bradley Intelligent Antenna Supported Data Types

The Allen-Bradley Intelligent Antenna communicates supports the following tag types:

Tag Type	Access type
0	Read
16	Read/Write
17	Read/Write
32	Read/Write
33	Read/Write
34	Read/Write

Allen-Bradley Intelligent Antenna Related Documents

You should have the following documentation available when configuring this interface option:

Allen-Bradley Intelligent Antenna User Manual (Cat. No. 2750-ND002)

This document is shipped with each Intelligent Antenna. It discusses the issues involved in configuring the communication and operation parameters of the Intelligent Antenna.

Allen-Bradley Intelligent Antenna Configuration

Configure the Allen-Bradley Intelligent Antenna with the following communication and operational parameters.

Physical Protocol	RS-232
Baud Rate	9600
Parity	None
Communication Mode	Byte swapping mode Enabled

See the ***Allen-Bradley Intelligent Antenna User Manual*** for details on setting these parameters

Allen-Bradley RFID Diagnostic Program

You can use the AB RFID Diagnostics program, **`abrfid_diag.exe`**, to verify hardware installation and communication operation.

To run the AB RFID diagnostics, execute the following command in a *Command Prompt* window opened from the CIMPLICITY HMI project's *Configuration* cabinet:

```
abrfid_diag.exe <port> <baud_rate> [<init_flag>
<counter>]
```

where:

`<port>` is the name of the port connected to the connection cable.

`<baud_rate>` has a default value of 9600.

`<init_flag>` is optional to let the program initialize antenna setting only.

`<counter>` is optional to indicate number of read operations that should be invoked. Default value of counter is 20.

For example, executing the following command initializes the antenna setting only:

```
abrfid_diag.exe COM2 9600 i
```

The following command reads data for three points:

```
abrfid_diag.exe COM2 9600 10
```

After the command is issued, the program will ask:

```
Do you like to test write tag command?(y/n)
```

Answer **y** to allow the program to write data to the tag.

The program then will ask:

```
Please enter the number of read tag operations invoked
before each write
```

Enter the number of operations you want.

When the program is ready to write data to tag, user will be asked for the data to be written.

The following is sample output for the program:

```
abrfid_diag parameters: Port = COM1, baud_rate = 9600, repeat count
= 10
Do you like to test write tag command? (y/n)
Y
Please enter number of read tag operations invoked before each
write:
1
!!!!!use echo command to test the communication link to the
antenna.
The antenna echoed: Hello!
!!!!!echo command finished.
Counter = 1
Read data for R0, element = 1.
Operation failed. Possible cause – no tag present.
   Data from antenna:
Read data from R0, element = 6.
   Data from antenna: 016405
Read data from R1, element = 2.
   Data from antenna: 16
Please input 2 bytes of data to write to tag memory:
11
Write data to R1, element = 2.
Write tag command: W 1 002 11
Tag detected, operation failed. Return code: 9
Possible cause – RF power low, wrong tag type.
Write data for point R1 failed.
…
abrfid_diag program finished successfully.
```

Allen-Bradley Intelligent Antenna Application Configuration

When you configure ports, devices, and points that use Allen-Bradley Intelligent Antenna Communications enabler, some fields must contain unique values for the communications to work successfully. These are detailed below.

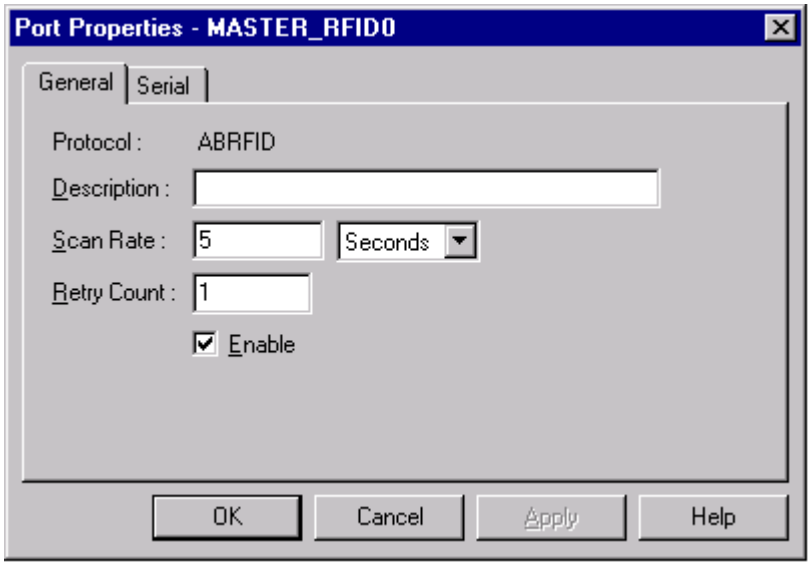
Allen-Bradley Intelligent Antenna Port Configuration

When you configure a new port for Allen-Bradley Intelligent Antenna communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **ABRFID** from the list of protocols.
2. In the **Port** field, select the communication port that will be used for Allen-Bradley Intelligent Antenna communications.

When you click **OK** to create the port, the *Port Properties* dialog box opens.

General Port Properties



Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description — Enter an optional description to help you identify the port.

Scan Rate — Enter the base scan rate for the port. Point scan rates are multiples of the base rate.

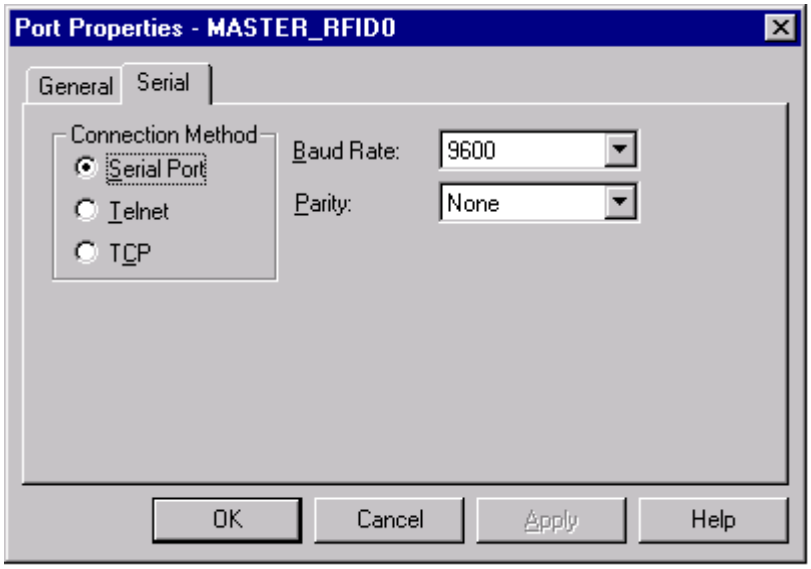
You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count — If communications cannot be established, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to a device on this port after a communications error is detected.

Enable — Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Serial Port Properties - Serial Connection



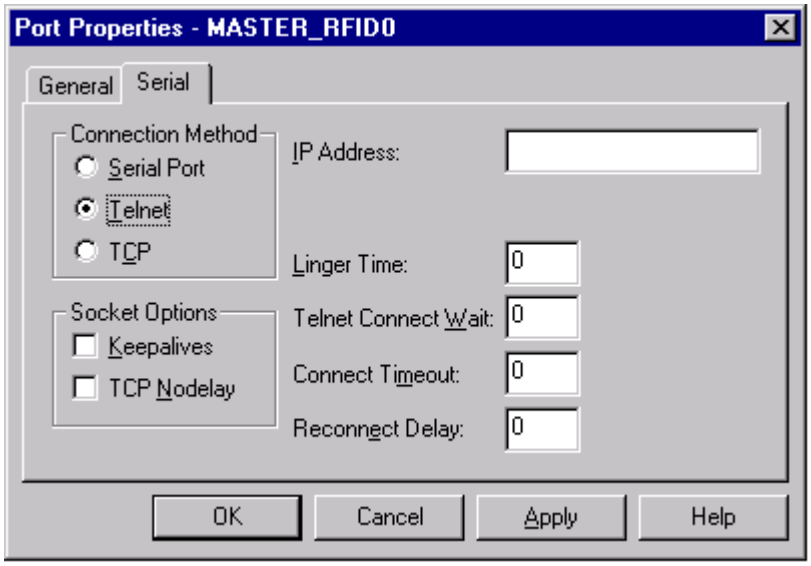
If you select the **Serial Port** connection method on the *Serial* tab in the *Port* Properties dialog box, you need to define the following:

Baud Rate — Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.

Parity — Select the parity to be used for communications.

Remember that you must configure the same baud rate, data bits, parity, stop bits and flow control for all PLCs using the serial port.

Serial Port Properties - Telnet or TCP Connection



If you select the **Telnet** or **TCP** connection method on the *Serial* tab in the *Port Properties* dialog box, you need to define the following:

Socket Options

Select the **Keepalives** check box to use keepalives to detect the loss of the terminal server. Clear the check box if you do not want to use keepalives to detect the loss of the terminal server.

Select the **TCP Nodelay** check box if you want to set the Nodelay flag on the socket. Clear the check box if you do not want to set the Nodelay flag.

IP Address

Enter the IP address of the terminal server.

Linger Time

Enter the time in seconds to wait after closing the socket before aborting the socket.

Telnet Connect Wait

Enter the time in seconds to wait for the Telnet protocol to initialize.

Connect Timeout

Enter the time in seconds to wait for the TCP connection to form.

Reconnect Delay

Enter the time in seconds to wait before attempting to reconnect to a device.

If you set this value to zero and the terminal server is not available, no attempts will be made to reconnect to the terminal server.

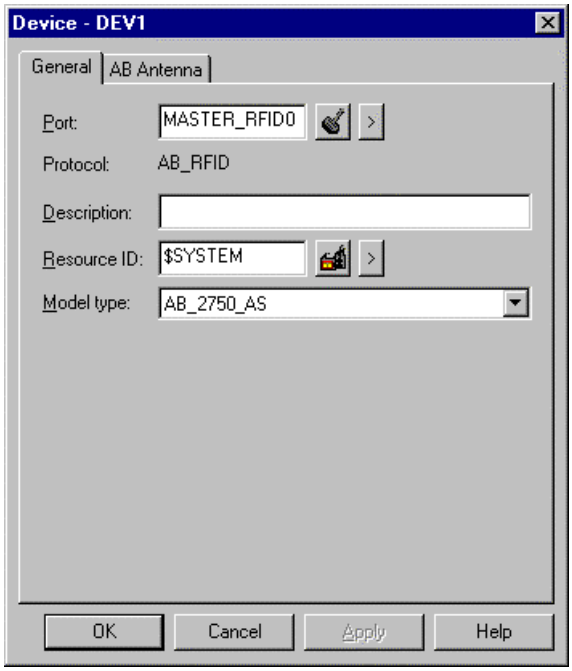
Allen-Bradley Intelligent Antenna Device Configuration

When you create a new device for Allen-Bradley Intelligent Antenna Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the ABRFID port to be used by the device.

When you click **OK** to create the port, the *Device Properties* dialog box opens.

General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

You can click the Browser button to the right of the field to display the list of ports and select one.

You can click the Pop-up Menu button to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

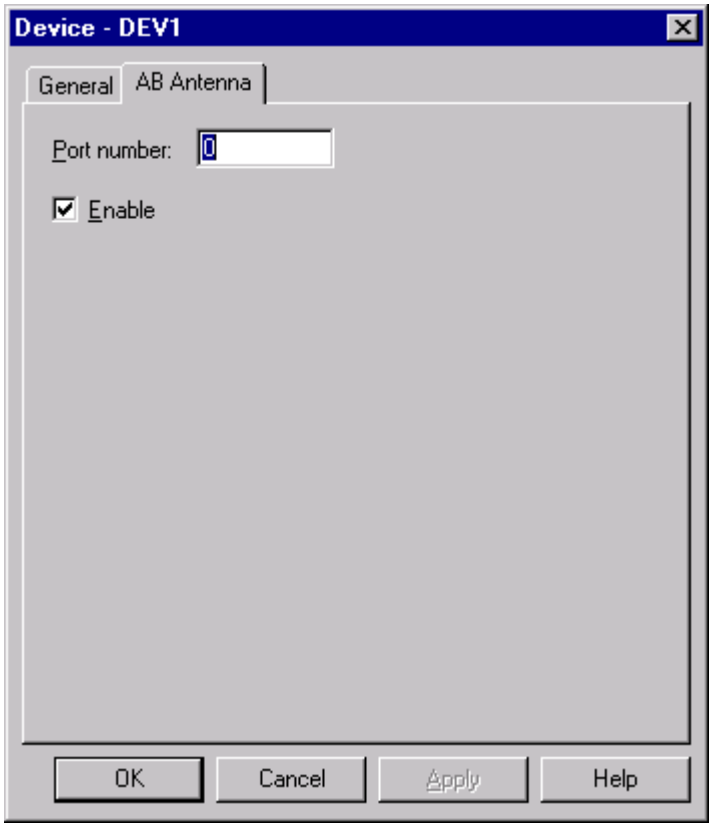
Resource Enter a resource that can be associated with this device for alarm generation.

You can click the Browser button to the right of the field to display the list of resources and select one.

You can click the Pop-up Menu button to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type There is only one model, **AB_2750-AS**.

Default Device Properties



Use the Default tab in the Device dialog box to enter information about Allen-Bradley Intelligent Antenna communications for the device. You can define the following:

Port number — For serial port connections, enter the local port number

For TCP or Telnet connections, enter the TCP port number on the terminal server where this antenna resides.

Enable — Select this check box to enable the device when the project starts. Clear this check box to disable the device. Points associated with the device will be unavailable.

Point Configuration

When you define a point, the following fields have values that are unique to or have special meaning for Allen-Bradley Intelligent Antenna communications:

General Point Properties

On the General tab in the Point Properties dialog box, you may configure points for **Read** or **Read/Write** access as follows:

Tag Type	Range	Access type
0	6-digit 20 or 40 char	Read
16	0 - 2047	Read/Write
17	0 - 8191	Read/Write
32	0 - 6	Read/Write
33	0 – 20	Read/Write
34	0 - 40	Read/Write

Note

For tag type 0, there are 3 possible ranges. Points must be configured within the memory range of the tag, otherwise read operations might fail and the communication with the tag would die.

Intelligent Antenna Configuration

The Allen-Bradley Intelligent Antenna contains four configuration settings. These four settings are:

- Tag Type
- Object Detect Mode
- Object Detect Timeout
- RF Field Strength

CIMPLICITY HMI software stores these four settings for every device (antenna) in your project in a standard Windows INI file named **ABRFID.INI**. This file resides in the **%SITE_ROOT%** (project root) directory.

Every time you start your CIMPLICITY HMI project, the Allen-Bradley Intelligent Antenna communications enabler queries each antenna for its current configuration settings. It then compares these values against those in the **ABRFID.INI** file.

If the configuration settings for a particular antenna do not exist in the **ABRFID.INI** file (or the **ABRFID.INI** file does not exist), the file is updated (or created) with the antenna's current configuration settings.

If the configuration settings for a particular antenna exist in the **ABRFID.INI** file, and the four values match the current antenna configuration, then no further action is taken.

If the configuration settings for a particular antenna exist in the **ABRFID.INI** file, and any of the four values do *not* match the antenna's current configuration, then the values from the **ABRFID.INI** file are written to the antenna, updating the antenna's configuration.

Updating an Antenna's Configuration File

You can override the antenna's default configuration by maintaining the values in the **ABRFID.INI** file. As with any Windows INI file, modifications are made with a text editor (such as *Notepad*). Use the following procedure to make changes to the **ABRFID.INI** file:

1. From the *Configuration* cabinet for your CIMPLICITY HMI project, select **Command Prompt** from the **Tools** menu.

   The *Command Prompt* window opens.

2. In the *Command Prompt* window, type **NOTEPAD ABRFID.INI**

The contents of the file will look similar to the lines below, depending upon the names you have chosen for the Allen-Bradley Intelligent Antenna devices in your project:

```
[ANTENNA1]
TagType=16
ObjectDetectMode=1
ObjectDetectTimeout=1000
RFFieldStrength=3

[ANTENNA2]
TagType=16
ObjectDetectMode=1
ObjectDetectTimeout=1000
RFFieldStrength=3

[ANTENNA3]
TagType=16
ObjectDetectMode=1
ObjectDetectTimeout=1000
RFFieldStrength=3
```

The text inside the square brackets identifies which device (antenna) the settings are for. This is the name you gave the device during Device Configuration. The values correspond to those from table 6.B in the ***Allen-Bradley Intelligent Antenna User's Manual***. Please refer to the user manual for the definitions of these values.

After you complete the modifications you need to make, and save the **ABRFID.INI** file, close *Notepad* and then close the *Command Prompt* window.

Updating the Antenna Configuration Settings

There are two methods of getting the Allen-Bradley Intelligent Antenna communications enabler to update the antenna's configuration settings based on the modifications to the **`ABRFID.INI`** file.

- You can stop and restart the CIMPLICITY HMI project. This is usually not a feasible thing to do.
- You can update the configuration settings dynamically for a particular antenna, without affecting the flow of data from the rest of the antennas in your project:

To updated the configuration settings dynamically, use the following procedure:

1. In the project's *Configuration* cabinet, select **Dynamic** from the **Tools** menu. You can now change the device properties without having to stop and restart the project.
2. In the project's *Configuration* cabinet, double-click on the *Devices* icon. The *Devices* window opens and shows you a list of all of the devices (antennas) in your project.
3. From the list of devices in the *Devices* window, double click on the antenna you wish to update. This opens the *Device Properties* dialog box.
4. In the *Device Properties* dialog box for the antenna:
   A. Clear the **Enabled** check box.
   B. Click **Apply**.
   C. Select the **Enabled** check box.
   D. Click **OK** to close the dialog box.
5. Close the *Devices* window.

Viewing an Antenna's Current Configuration

You can configure Diagnostic Points for each antenna in your CIMPLICITY HMI project to display an antenna's current configuration values.

Diagnostic Points are configured the same as any other device point, except that a special address value is used, and the **Diagnostic Data** checkbox is selected. The four special addresses you will use to create these Diagnostic Points are:

Configuration Value	Point Address	Point Type
Tag Type	**$TAG_TYPE**	USINT
Object Detect Mode	**$OBJECT_DETECT_MODE**	USINT
Object Detect Timeout	**$OBJECT_DETECT_TIMEOUT**	UINT
RF Field Strength	**$RF_FIELD_STRENGTH**	USINT

Configuring a Diagnostic Point

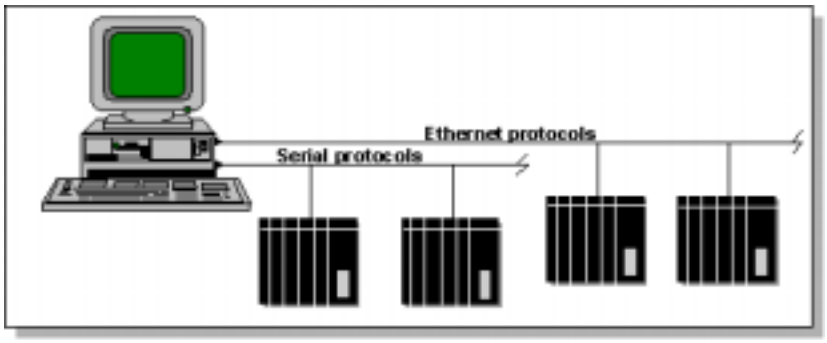
To create a Diagnostic Point that displays a current antenna configuration value:

1. Open the *Point Configuration* window.
2. Create a new point.
3. In the *New Point* dialog box:
   - Enter a name for the point in the **Point ID** field.
   - Select **Device Point** for **Point Origin**.
   - Select **Analog** for **Point Class**.
   - Click **OK**.
4. In the *General* tab of the *Point Properties* dialog box for the new point, make sure you:
   - Select a **Resource ID** for the point.
   - Enter the correct Point Type in the **Type** field.
5. In the *Devices* tab of the *Point Properties* dialog box for the new point, make sure you:
   - Enter the correct Point Address for the Diagnostic Point in the **Address** field.
   - Select the **Diagnostic Data** check box.
   - For **Update Criteria**, select **On Change**.
   - Set the scan rate as you see fit.
6. Click **OK** to add the Diagnostic Point to the list of points.

APPLICOM Communications

About APPLICOM Communications

The APPLICOM Communications enabler uses APPLICOM Communication Server hardware and software to communicate with a variety of devices from different vendors using appropriate protocols.



Using this enabler, CIMPLICITY HMI software can:

- Poll points at a user-defined scan rate, on demand, or once at startup
- Read and write single points
- Read arrays
- Perform Engineering Unit conversion for meaningful point value displays
- Issue alarms to users when a device goes down
- Access the APPLICOM interface database

This enabler can support up to eight (8) APPLICOM interface cards in one computer.

This enabler supports the following CIMPLICITY HMI features:

- Polled read at user defined rates
- Poll after setpoint
- Triggered reads
- Analog deadband
- Alarm on communications failure
- Server redundancy configuration

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

APPLICOM Communications Supported Protocols

Through the APPLICOM Communications enabler, the APPLICOM device communications enabler supports the following protocols:

- April *JBUS*
- Klöckner-Moeller SUCOMA
- Modbus RTU
- Omron SYSMAC-WAY
- Otic Fischer & Porter *Datalink*
- Profibus DP
- SAIA *SBUS*
- Siemens 3964 or 3964R
- Siemens *PPI*
- Siemens Profibus FMS
- Siemens SINEC H1 HTB and H1-TF
- Siemens SINEC L2/S5
- Télémécanique ETHWAY
- Télémécanique FIPWAY
- Télémécanique UNI-TELWAY

The APPLICOM device communications enabler also supports access to the database on each APPLICOM interface card.

For more information on these protocol and their hardware and software requirements, see the ***APPLICOM Communication Server*** documentation.

APPLICOM Communications Supported Data Types

APPLICOM Generic Device Data Types

The following data types may be read from and written to generic devices accessed through the APPLICOM Communications enabler. Not all data types are available for all devices.

Tag	Memory domain
B	Bits
BI	Input bits
BO	Output bits
O	Bytes
OI	Input bytes
OO	Output bytes
W	Words
WI	Input words
WO	Output words
D	Double words
F	Floating point values

APPLICOM Interface Database Data Types

The following data types may be read from and written to the APPLICOM interface internal database:

Type	Description
B	Bit data
O	Byte (octet) data
W	Word data (16 bits)
F	Floating point data
D	Double word data (32 bits)

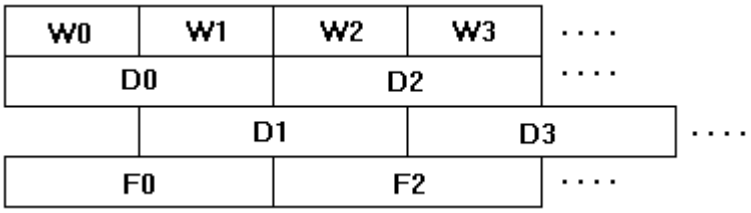
Notes on Database Data Types

Byte, Word, Double Word and Floating Point data are all stored in the same area of the database. This area is organized in 16 bit words addressed from 0 to 32,767 (decimal).

There are 32,766 double words. Each double word starts on a word boundary thus a DINT point configured at address D0 overlaps one configured at D1 by one word. The most significant word of the point at D0 is the least significant word of the point at D1. In addition, a point configured at D0 is identical to one configured at W0. The last double word is at D32766 and includes words 32,766 and 32,767.

There are 16,383 floating-point values addressed with even numbers from 0 to 32,766. Each value takes up two words starting on an even word boundary. Thus, a REAL point at address F0 coincides with a DINT point at address D0, and a REAL point at F2 coincides with a UDINT point at D2.

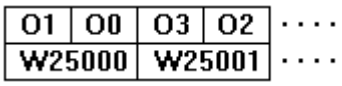
The following illustrates the relationship between Word (W), Double Word (D), and Floating Point (F) data in the internal database:



For example:

- If R is a 3-element REAL array point at address F4, R[0] contains F4, R[1] contains F6, and R[2] contains F8.
- If S is a 3-element DINT array point at address D3, S[0] contains D3, S[1] contains D5 and S[2] contains D7.
- If T is a 3-element DINT array point at address D4, T[0] contains D4, T[1] contains D6, and T[2] contains D8.

There are 14,000 bytes stored in words 25,000 through 31,999. In this Byte addressable area, the relationship between Word (W) and Byte (O) data is:



A point of type SINT with address O0 (oh zero) retrieves the least significant byte of word 25,000. Address O1 (oh one) is the most significant byte of word 25,000. A SINT or USINT point configured at O0 (oh zero) is identical to one configured at W25000.

Siemens Device Data Types

The following data types may be read from and written to Siemens devices accessed through the APPLICOM Communications enabler:

Type	Description
M	Bits
E	Input bits
A	Output bits
MB	Bytes
EB	Input bytes
AB	Output bytes
MW	Words
EW	Input words
AW	Output words
MD	Double words

The following data types may be read from and written to Siemens data blocks accessed through the APPLICOM Communications enabler:

Type	Description
DP	Bits
DW	Words
DD	Double words

APPLICOM Required Hardware and Software

The APPLICOM Communications enabler is supported on personal computers based on Intel 80486 and compatible processors. It requires the following hardware and software:

- One or more APPLICOM interface cards
- APPLICOM Communication Server version 2.8 or later

These items are available from your APPLICOM distributor.

APPLICOM Related Documents

When configuring this interface option you should have the ***APPLICOM Communication Server*** manual, as well as documentation specific to the communication protocol and devices you are using.

APPLICOM Card Configuration

The APPLICOM interface cards are configured with PCCONF. This APPLICOM Server Configuration tool comes with each card.

PCCONF

To start the card configuration program, double-click the *PCCONF* icon in the APPLICOM SERVER Common project.

Refer to the APPLICOM documentation for details on using this utility.

You may have up to eight cards (numbered 1 through 8) installed in your computer. Each card supports up to 4 channels (numbered 0 through 3). The channels may be serial, Ethernet, or protocol-specific.

Directory Path for APPLICOM Communications

After you install the APPLICOM Communication Server drivers, you must include their directory path in the **PATH** environment variable on your CIMPLICITY HMI computer.

To do this:

1. Shut down all CIMPLICITY HMI projects on the computer.
2. From the **Start** menu, select **Settings**.
3. In the **Settings** menu, select **Control Panel**.
4. In the *Control Panel* window, select **System**.
5. In the *System Properties* dialog box, select the *Environment* tab.
6. Highlight the **Path** environment variable in the **System Variables** list.
7. In the **Value** field, add the directory location of the APPLICOM Communication Server drivers to the end of the list.

   For example, if the drivers are located in **c:\applicom**, add **;C:\APPLICOM** to the end of the value.
8. Select **Set** to make the addition part of the **Path** environment variable.
9. Select **OK** to close the *System Properties* dialog box.
10. Exit the *Control Panel* window.
11. Reboot the computer to make the environment variable change active.
12. Follow the directions for starting the APPLICOM Communication Server drivers.
13. Start your CIMPLICITY HMI projects.

APPLICOM Installation Verification

The APPLICOM Communication Server comes with diagnostic and utility programs that you can use to verify configuration and communication. Refer to the APPLICOM documentation for details.

APPLICOM Application Configuration

Up to eight APPLICOM interface cards may be installed in a single computer. Each interface card may have up to four channels, and each channel may have up to 256 devices. A single APPLICOM Communication Server provides access to all these devices for up to eight client programs.

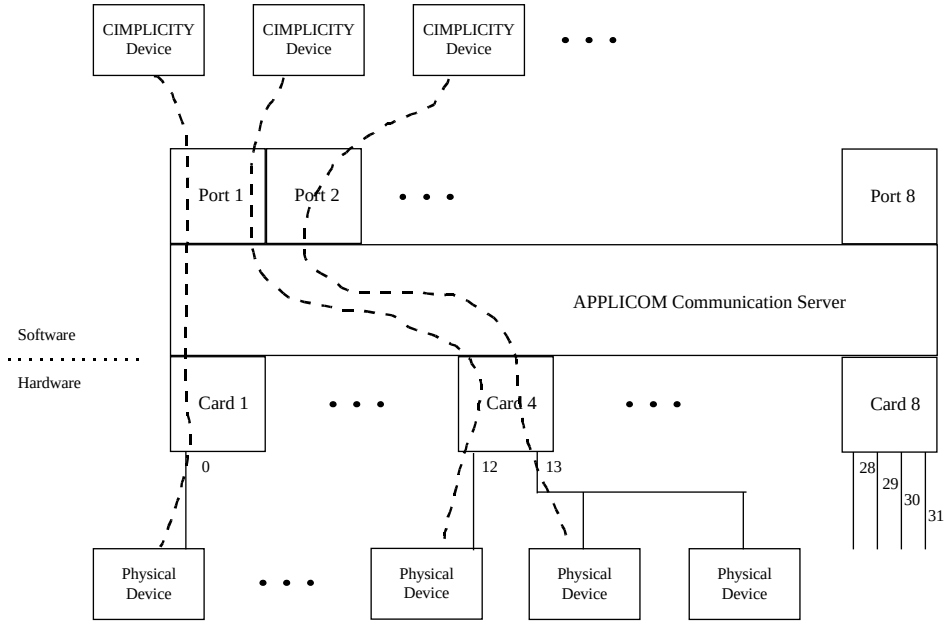
Each CIMPLICITY port using the APPLICOM Communications enabler is a client of the APPLICOM Communication Server. If no other client programs are accessing the server, you can configure up to eight ports.

Because all device access in through a single APPLICOM server, all devices on all channels may be accessed via any CIMPLICITY port. You may:

- Use a single port for all your devices
- Use ports to logically group devices by APPLICOM interface, by device type, or by process area, or by some other criteria.

In the latter case, you can control a logical group of devices by enabling and disabling a single CIMPLICITY port. Devices on other ports accessed via the APPLICOM Communications enabler would continue to be available.

The following figure illustrates the relationship between CIMPLICITY ports, the APPLICOM Communication Server, APPLICOM interfaces, and communication channels.



When you configure ports, devices, and points that use the APPLICOM Communication enabler, some fields must contain unique values for the communications to work successfully. These are detailed below.

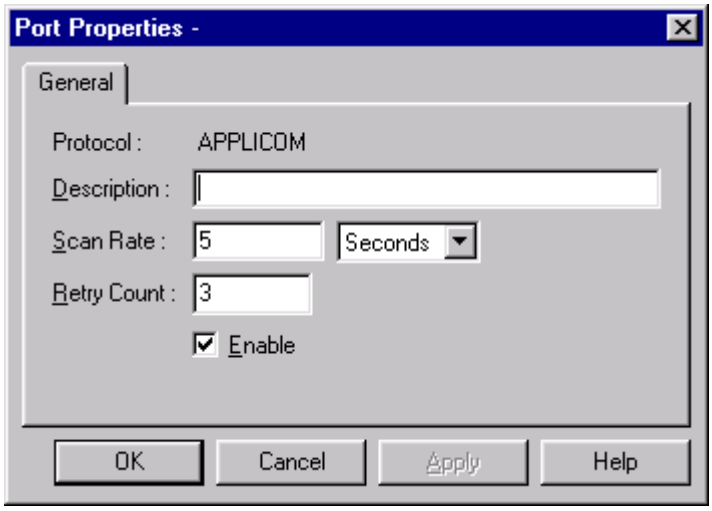
Port Configuration

When you configure a new port for APPLICOM communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **APPLICOM** from the list of protocols.
2. In the **Port** field, select the communication port that will be used for APPLICOM communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

General Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description — Enter an optional description to help you identify the port.

Scan Rate — Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count — If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.

Enable — Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

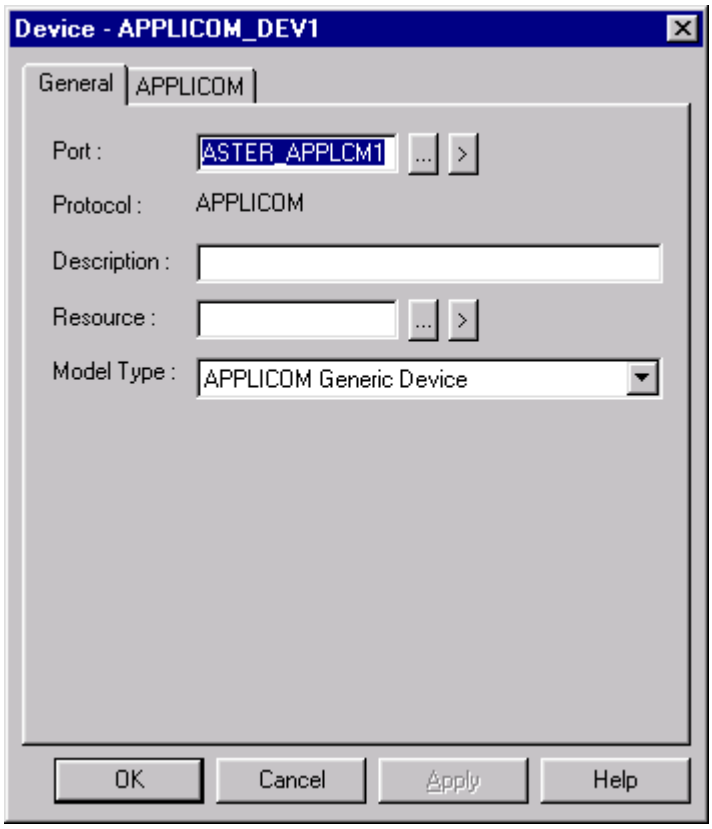
APPLICOM Device Configuration

When you create a new device for APPLICOM Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the APPLICOM port to be used by the device.

When you select **OK** to create the port, the *Device Properties* dialog box opens.

General Device Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - ... - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - > - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button - - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. The options are:

APPLICOM Generic Device
APPLICOM Interface Database
Siemens Device

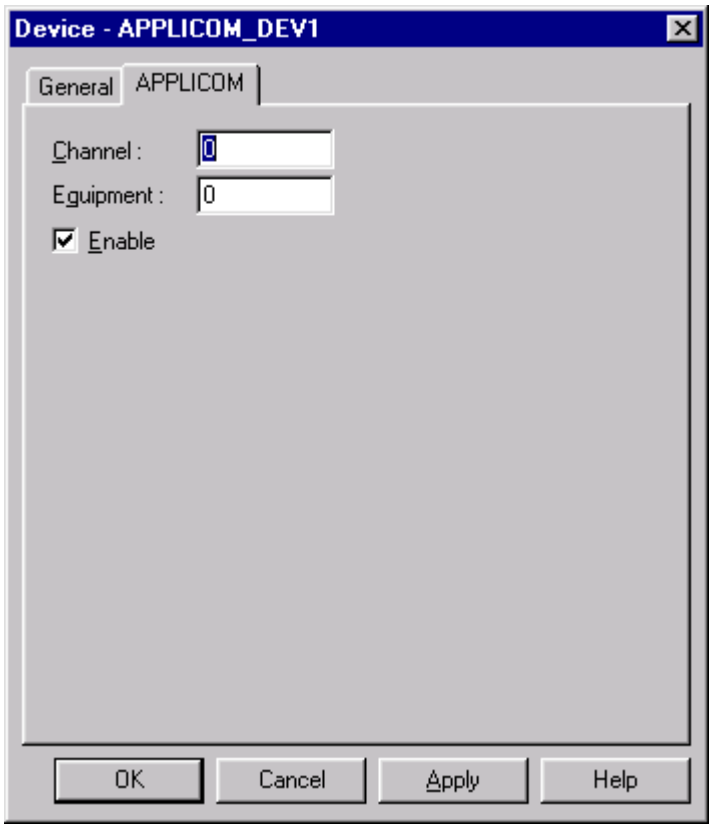
For Siemens devices, select **Siemens Device**. This will let you configure points with Siemens addressing rather than generic addressing.

For all other devices supported by the APPLICOM Communication Server, select **APPLICOM Generic Device**.

For access to the interface database, select **APPLICOM Interface Database**.

Depending on the Model Type you choose, one of two APPLICOM dialogs will be available. For the type **APPLICOM Interface Database**, you may specify the card number of the database. For other models types, you may specify the channel and equipment numbers for the device.

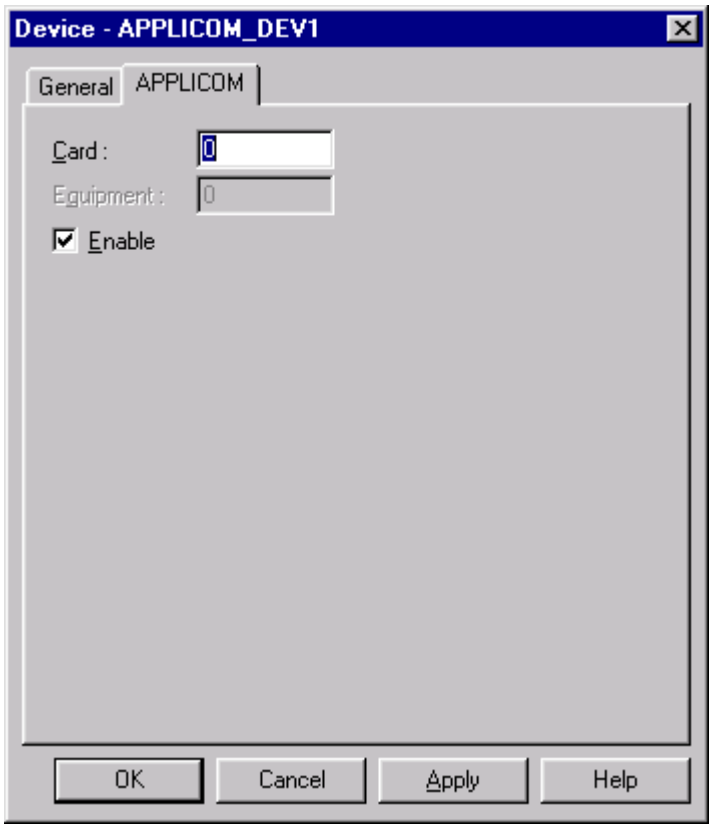
APPLICOM Device Properties



When you configure a physical device on the APPLICOM protocol, use the *APPLICOM* properties to enter information about APPLICOM communications for the device. You can define the following:

Channel	Enter the APPLICOM channel ID for the device. The channel ID is an integer from 0 to 31. Channels 0 to 3 are on card 1, channels 4 to 7 are on card 2, etc.
Equipment	Enter the APPLICOM equipment ID for the device as configured in PCCONF.
Enable	Set this check box if you want the device to be enabled when the project starts. If you clear this check box, the device will not be enabled when the project starts, and points will not be available for this device.

APPLICOM Database Properties



When you configure an **APPLICOM Database**, use the *APPLICOM* properties to enter information about the interface card. You can define the following:

Card	Enter the APPLICOM card ID for the interface card. The card ID is an integer from 1 to 8.
Equipment	*Not used.*
Enable	Set this check box if you want the device to be enabled when the project starts. If you clear this check box, the device will not be enabled when the project starts, and points will not be available for this device.

Point Configuration

You can configure points that correspond to values in a physical device, or to values in each APPLICOM interface's internal database.

When you define a point, the following fields have values that are unique to or have special meaning for APPLICOM communications:

General Point Properties

On the General tab in the Point Properties dialog box, you may configure points for **Read** or **Read/Write** access.

Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria: The update criteria determines how the data will be requested. Click the drop-down button to the right of the input field to display your choices, then make a selection.

Select **On Change** or **On Scan** for points whose values should be polled by the APPLICOM driver at regular intervals.

Select **On Demand On Change** or **On Demand On Scan** for points whose values should only be polled when needed.

Select **Poll Once** for points whose values should be polled by the APPLICOM driver only at startup or when the point is dynamically configured

Address: Use the point address format for the device's model type. The address formats are:

APPLICOM Generic Device
APPLICOM Interface Database
Siemens Device

When you are configuring array points, make sure that the size of the array is within the limits of the domain. CIMPLICITY software does not declare an array configured beyond the end of a domain as invalid. If an array point is configured that extends beyond the end of a domain, a $DEVICE_DOWN alarm will be generated each time an attempt is made to read data from or write data to the point.

APPLICOM Point Address Formats

APPLICOM Generic Point Addresses

The general point address format is:

<TAG><OFFSET>

where:

<TAG> is a model-dependent prefix which specifies the memory domain. Valid prefixes are:

Tag	Memory domain
B	Bits
BI	Input bits
BO	Output bits
O	Bytes
OI	Input bytes
OO	Output bytes
W	Words
WI	Input words
WO	Output words
D	Double words
F	Floating point values

Note

Not all devices support all memory types.

<OFFSET> is the offset of the item within the domain. The generic APPLICOM device type supports the following offsets:

- Decimal addressing (radix 10)
- Address of the first element (minimum address) is 0.

APPLICOM Interface Database Addresses

The general point address format is:

<TAG><OFFSET>

where:

<TAG> is a model-dependent prefix which specifies the memory domain. Valid prefixes are:

Tag	Memory domain
B	Bits
O	Bytes
W	Words
D	Double words
F	Floating point values

<OFFSET> is the offset of the item within the domain. The APPLICOM Interface Database device type supports the following offsets:

- Decimal addressing (radix 10)
- Address of the first element (minimum address) is 0.

For example, when configuring a point in the APPLICOM interface database, **W23** is the 24th word value in the database (because database domains are numbered starting at 0). The **W** specifies the word domain and the **23** specifies which word.

Siemens Point Addresses

Data in Siemens devices can be read from device memory or data blocks.

When you select **Siemens Device** for the device model, you enter point addresses in Siemens nomenclature. These addresses are then translated by the APPLICOM Communications enabler into the corresponding APPLICOM references according to the formulas shown in the ***APPLICOM Communication Server*** manual.

For example, each data block is offset 256 items from the previous, so **DB150DW23** converts to an APPLICOM generic address of 38423 (or [150 * 256] + 23).

Device Memory Addresses

When you specify addresses for points in device memory, use the following general format:

<TAG><INDEX>

where:

<TAG> is memory type. Valid memory types are:

Type	Description
M	Bits
E	Input bits
A	Output bits
MB	Bytes
EB	Input bytes
AB	Output bytes
MW	Words
EW	Input words
AW	Output words
MD	Double words

<INDEX> is the index of the item within the device memory. The index may be in octal, decimal, or hexadecimal depending on the device model.

Data Block Addresses

When you specify addresses for points in data blocks, use the following general format:

DB<BLOCK><TAG><INDEX>

where:

<BLOCK> is the data block number.

<TAG> is data type. Valid data types are:

Type	Description
DP	Bits
DW	Words
DD	Double words

<INDEX> is the index of the item within the data block. The index may be in octal, decimal, or hexadecimal depending on the device model.

For example, **DB150DW23** is data word 23 in data block 150.

APPLICOM Domain Configuration

Some aspects of APPLICOM point configuration are controlled by the configuration file **%SITE_ROOT%\data\applicom.cfg**. Generally, you should not have to modify this file. However, you may modify it to:

- Add explicit support for new devices
- Change point address tags to match local conventions
- Limit address ranges

Field Definitions

The memory domains for devices using the APPLICOM Communications enabler are configured in **%SITE_ROOT%\data\applicom.cfg**. This file is in IDT format with the following fields:

```
model|applicom type|name|tag|radix|min_addr|max_addr
```

model

The model number of the device. This corresponds to an entry in the .MODEL file for the protocol.

The valid model numbers for the APPLICOM Communications enabler are:

60 APPLICOM Interface Database
61 APPLICOM Generic Device
62 Siemens Device

applicom type

A valid APPLICOM domain type. Valid types are:

- **0** Bits
- **1** Input bits
- **2** Output bits
- **3** Bytes
- **4** Input bytes
- **5** Output bytes
- **6** 16 bit words
- **7** Input 16 bit words
- **8** Output 16 bit words
- **9** BCD words
- **10** Double (32 bit) words
- **11** Floating point values (CIMPLICITY **Real** values)

name

The name of the domain. The maximum length is 16 characters.

tag

The tag for point addresses in the domain. For a model, each domain must have a unique tag. This is used in point configuration.

The tag may contain any character except **|**, **-**, *****, **?**, and ****.

The combined length of the tag and index for a point cannot exceed 32 characters.

radix

Base for converting point address offsets. Defaults to 10 if blank. Suggested values are 8 (octal), 10 (decimal), and 16 (hexadecimal); but any value from 2 to 36 is acceptable.

min_addr

Minimum address. The address of the first element in the domain. Typically, 0 or 1 but it may be anything.

This number is in the base specified in the **radix** field.

max_addr

Maximum address. The address of the last element in the domain. Must be greater than or equal to **min_addr**.

This number is in the base specified in the **radix** field.

Sample File

For example, the following file shows the default domain configuration for the database on the APPLICOM interface card:

```
|-*
* model|applicom type|name|tag|radix|min_addr|max_addr
* Addresses are 32-bit unsigned integers
60|0 |Bits|B|10|0|32767
60|3 |Bytes|O|10|0|13999
60|6 |Words|W|10|0|32767
60|10|Double words|D|10|0|32767
60|11|Floating|F|10|0|32767
```

For another example, a domain of 65,535 16-bit input words which is naturally addressed **%I[x]** (where **x** is a hexadecimal number), can be specified like:

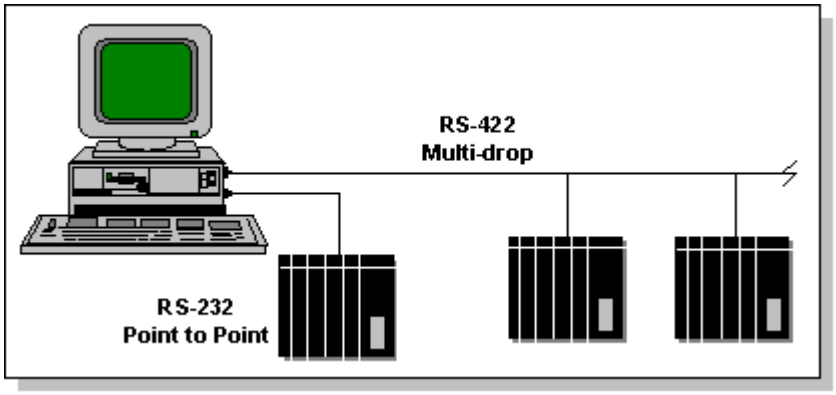
```
61|7|Word Inputs|%I[|16|0|FFFF
```

A point address like "**%I[6f]**" is parsed into a tag of "**%I[**" and an offset of "**6f**". The "**]**" suffix is ignored.

CCM2 Communications

About CCM2 Communications

The CCM2 Communications enabler uses the CCM2 protocol to communicate with GE Fanuc Series Six™, Series Five™, and Series 90™ programmable controllers. Using CCM2 master-slave protocol, this enabler acts as a master PLC and supports point to point and multi-drop configurations.



This enabler supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integer
- Unsigned 8, 16, and 32 bit integer
- Floating point
- Text
- Arrays

Supported CCM2 Devices and Memory Types

The following devices and memory types are supported by the CCM2 Communications option:

Series 90-30

The following memory types are support on a Series 90-30:

Memory Type	Description
R	Registers
I	Inputs
O	Outputs

Series 90-70

The following memory types are support on a Series 90-70:

Memory Type	Description
R	Registers
I	Inputs
O	Outputs

Series Six

The following memory types are supported on a Series Six:

Memory Type	Description
R	Registers
I	Inputs
O	Outputs
IO	Input Overrides
OO	Output Overrides
AI	Auxiliary Inputs
AO	Auxiliary Outputs
AI-	Internal Auxiliary Inputs
AO-	Internal Auxiliary Outputs
I<chan>+	Real Expanded (Channelized) Inputs
O<chan>+	Real Expanded (Channelized) Outputs
I<chan>-	Internal Expanded (Channelized) Inputs
O<chan>-	Internal Expanded (Channelized) Outputs

where **<chan>** is the hexadecimal channel number from 1 to F.

Series Five

The following memory types are supported on a Series Five:

Memory Type	Description
R	Registers
LI	Local Input
LIO	Local Input Overrides
I1+I	I1+ Inputs
I2+I	I2+ Inputs
I1+IO	I1+ Input Overrides
I2+IO	I2+ Input Overrides
SI	Special Inputs
LO	Local Output
LOO	Local Output Override
O1+O	O1+ Outputs
O2+O	O2+ Outputs
O1+OO	O1+ Output Overrides
O2+OO	O1+ Output Overrides
O1IC	O1- Internal Coils
O2IC	O2- Internal Coils
O1ICO	O1- Internal Coil Overrides
O2ICO	O2- Internal Coil Overrides

Related CCM2 Documents

You should have the appropriate documentation for your programmable controllers available when configuring this interface option. The following documents are available from GE Fanuc:

Series Six Programmable Controllers Data Communications Manual (GEK-25364)

Series Five Data Communications (GFK-0244)

Series 90 PLC Serial Communications User's Manual (GFK-0582)

CCM2 Hardware Installation External to the Computer

Configure the following parameters for the CCM2 communications port on each programmable controller that is to communicate with CIMPLICITY HMI software:

CPU ID	Each device on the same port must have a unique CPU ID.
Baud Rate (9600 or less)	All devices on the same port must be set to the same baud rate.
Parity (usually odd)	All devices on the same port must be set to the same parity.
Protocol	All devices must be configured as slave devices. Depending on your network configuration, select the Slave RS232 or Slave RS422 protocol.

Note

If you are using the J1 port on a Series Six CCM2 card, the parity is always odd.

Since this information is required when configuring the CIMPLICITY HMI communications port and the CIMPLICITY HMI device, you should record these values at this time.

Install the correct cables for CCM2 communications. See the appropriate GE Fanuc Data Communications manual for cabling instructions. In addition, if you are using Series 90 programmable controllers, the cabling is the same as for the SNP protocol.

CCM2 Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to CCM2 communications.

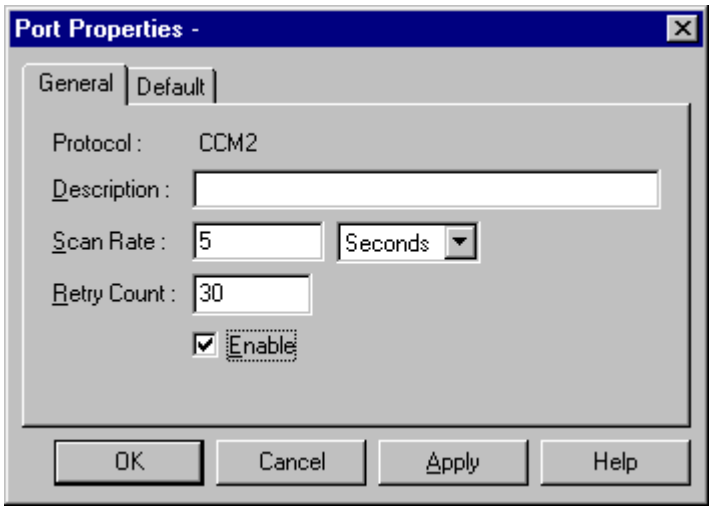
CCM2 Port Configuration

When you create a new port for CCM2 communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **CCM2** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for CCM2 communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

General Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description Enter an optional description to help you identify the port.

Scan Rate Enter the base scan rate for the port. Point scan rates will be in multiples of the base rate.

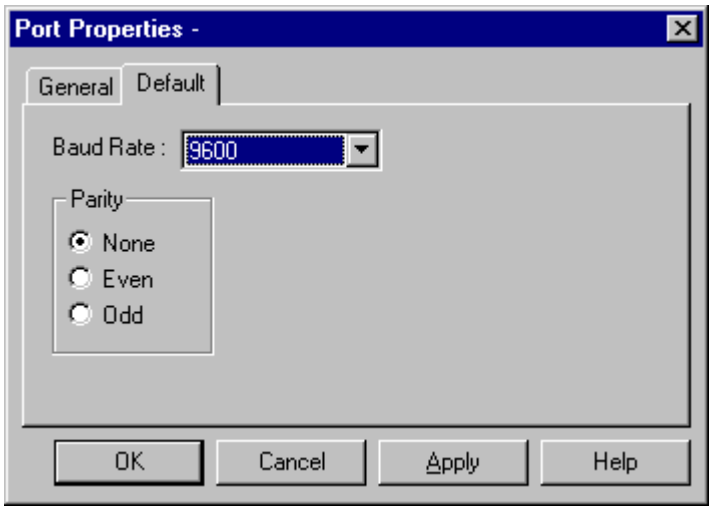
You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count If communications cannot be established, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for any devices on the port.

Default Properties



Use the *Default* properties to enter information about the CCM2 communications for the port. You can define the following:

Baud Rate Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.

Parity Select the parity for communications.

Note

Make sure the baud rate and parity you select match those on the programmable controller being used on this port.

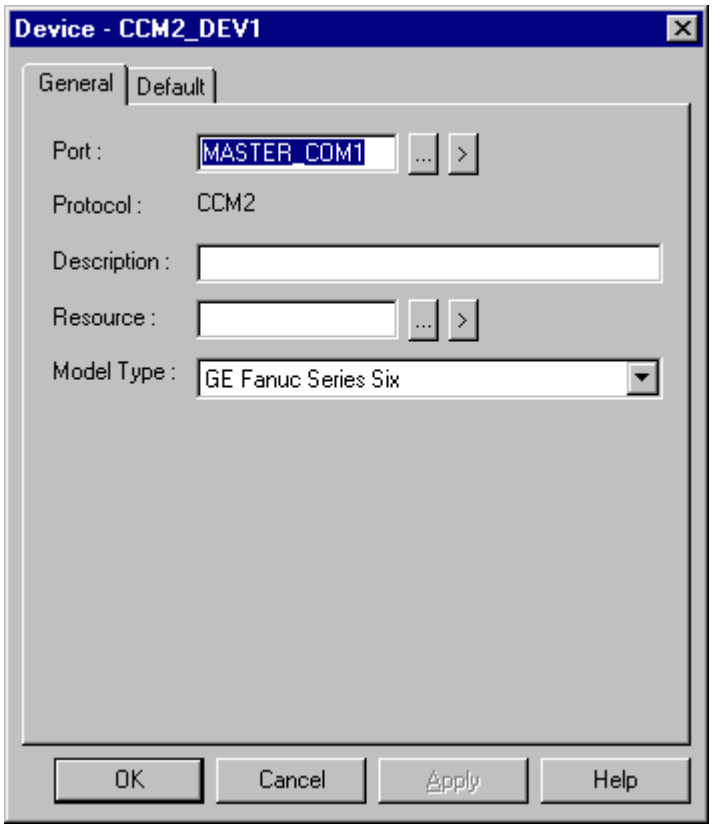
CCM2 Device Configuration

When you create a new device for CCM2 communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the CCM2 port to be used by the device.

When you select **OK** to create the device, the *Device Properties* dialog box opens.

General Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - ... - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - > - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button - ... - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - > - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the choices are:

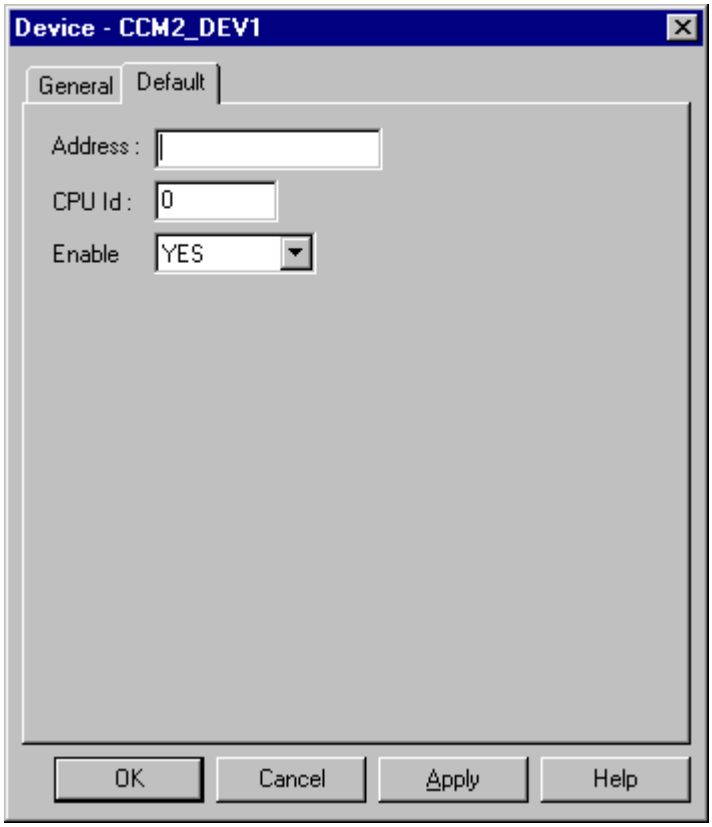
GE Fanuc Series Six

GE Fanuc Series Five

GE Fanuc Series 90-30

GE Fanuc Series 90-70

Default Properties



Use the *Default* properties to enter information about CCM2 device communications for the device. You can define the following:

Address *Not used.*

CPU ID This field must match the CPU ID that was set in the programmable controller.

Enable Select **Yes** in this box to enable the device when the project starts.

Select **No** to disable the device. The points associated with the device will be unavailable when the project starts.

CCM2 Point Configuration

When you define a point, the following fields have values that are unique to or have special meanings for CCM2 communications:

General Page

On the *General* property page, you may configure points for **Read** or **Read/Write** access.

Device Page

On the *Device* property page:

Address Point address requirements are device-dependent. For CCM2 communications, the address format is:

`<memory_type><offset>`

The memory types you can use are listed in the *Supported CCM2 Devices and Memory Types* section.

Update Criteria The update criteria determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by CCM2 communications at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by CCM2 communications at regular intervals when users are viewing them

When you are configuring Boolean points for memory types that are not bit addressable, you must also enter data in the following field:

Address Offset Enter the bit offset that corresponds to the bit position within the word.

CCM2 Point Configuration Notes

GE Fanuc programmable controllers follow the same basic addressing scheme. The address of a point is specified by selecting a memory type, a location in the memory type, and for Boolean points, a bit offset.

The range of addresses for each memory type varies from controller to controller and depends on the model and its configuration (for example, the amount of memory installed in the controller). Ranges are not checked during Point configuration. If you enter a Point address that is out of range (such as R2000 on a controller that has Registers 1-1024), run-time errors will occur. Generally, a point with a bad address displays the unavailable value. For **CimView** screens, the unavailable value is the default text for the point. For *Point Control Panel*, the unavailable value is ******.

Register Memory Addressing

Registers are 16 bit words. You can configure Analog or Boolean point types to read registers.

- For Analog point types, enter the address in the **Address** field. For example, R10 specifies Register 10.
- For Boolean point types, enter the register number in the **Address** field and the bit offset (from 0 to 15) in the **Address Offset** field. For example, an address of R25 with an address offset of 0 specifies the first bit in Register 25, while an address of R25 and an address offset of 4 specifies the fifth bit in Register 25.

Input/Output Memory Addressing

These memory types include:

- For the Series Six:

Inputs	Outputs
Input Overrides	Output Overrides
Auxiliary Inputs	Auxiliary Outputs
Internal Auxiliary Inputs	Internal Auxiliary Outputs
Real Expanded Inputs	Real Expanded Outputs
Internal Expanded Inputs	Internal Expanded Outputs

- For the Series Five

Local Inputs	Local Outputs
Local Input Overrides	Local Output Overrides
I1+ Inputs	O1+ Outputs
I2+ Inputs	O2+ Outputs
I1+ Input Overrides	O1+ Output Overrides
I2+ Input Overrides	O2+ Output Overrides
Special Input	O1- Internal Coils
	O2- Internal Coils
	O1- Internal Coils Overrides
	O2- Internal Coils Overrides

- For the Series 90

Input	Output

You can configure Analog and Boolean points in these memory types.

Analog Addressing

For Analog point types in Input/Output memory types, only addresses that fall on byte boundaries are valid for analog points. To verify that the address is valid, use the following formula:

```
check = (address - 1) mod 8
```

where **address** is the number of one of the starting bit in the memory type that you want to use for the Analog point address. If **check** is zero (0), the address is valid. Otherwise, the address is invalid.

For example, an address of I18 is *not* valid because:

```
check = (18 - 1) mod 8 = 17 mod 8 = 1
```

An address of I25 *is* valid because:

```
check = (25 - 1) mod 8 = 24 mod 8 = 0
```

Boolean Addressing

For Boolean point types in Input/Output memory types, enter the bit address in the **Address** field. For example, an address of I32 specifies Input 32.

Any values you enter in the **Address Offset** field are ignored for these memory types. For example, an address of O14 with an address offset of 2 specifies Output 14 (not Output 16).

DDE Client Communications

About CIMPLICITY DDE Client Communications

The CIMPLICITY HMI DDE Client Communication enabler acts as a DDE Client and is able to communicate with standard DDE Servers. A DDE Server uses a three-level hierarchy:

- Application (or Service) Name
- Topic Name
- Item Name

to uniquely identify a unit of data the Server can exchange during a conversation with a Client. Conforming to this hierarchy:

- A CIMPLICITY HMI device is associated with the Application and the Topic Name.
- A CIMPLICITY HMI point is associated with an Item Name.

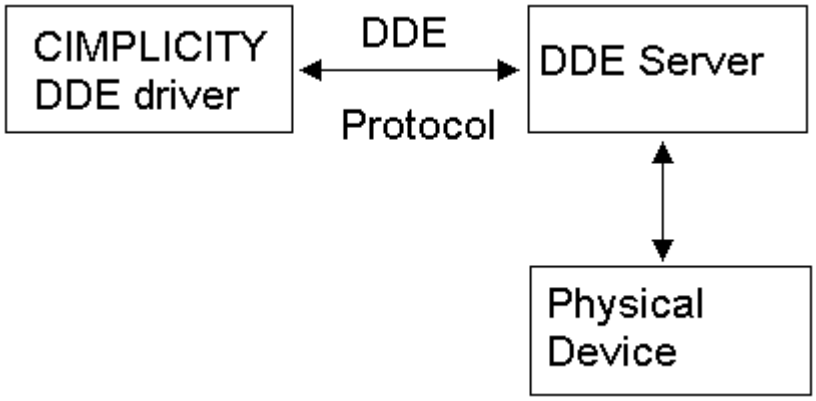
Typically, you must first configure a Topic through a configuration tool that is specific to the type of Server being used (usually the Topic identifies the physical address of the device). You then use that Topic Name, along with the Application Name, to configure the CIMPLCITY HMI Device (see the *DDE Device Properties* screen below). The CIMPLICITY HMI Device Point Address is the Item Name whose format is dictated by the specific Server being used.

The DDE Client Communications enabler is able to communicate with multiple DDE Servers at one time. Each server is defined as a separate CIMPLICITY HMI device.

The DDE Client Communications enabler provides the following features:

- Communication with multiple DDE Servers at the same time.
- Access to multiple Topics under a single Server at the same time.
- Communication with DDE or NetDDE Servers.
- Alarm generation when a communication failure occurs.
- Read and write accessible Items.
- A utility program, **`dde_diag.exe`**, which can be used to validate a DDE Server's Service, Topic and Item names.

Sample DDE Network



CIMPLICITY DDE Client Supported Protocols

The DDE Client Communications enabler supports the following protocols:

- DDE
- NetDDE
- AdvancedDDE™

DDE Required Hardware and Software

There is no additional hardware or software required for the DDE Client Communications enabler other than what might be required for the specific DDE Server you are using.

DDE Setup

For Windows 95, no special setup is required.

For Windows NT, you must change the default setting for the CIMPLICITY HMI service as follows:

1. From the **Start** menu, select **Settings**.
2. From the **Settings** menu, select **Control Panel**.
3. In the *Control Panel* program group, select **Services**.
4. In the *Services* dialog box, select the CIMPLICITY HMI service.
5. Select **Startup...**
6. In the *Service* dialog box:
   A. Set the **Log On As** field to **system account**.
   B. Enable the **Allow Service to Interact with Desktop** option.
   C. Select **OK** to close the *Service* dialog box and save your changes.
7. Select **Close** to close the *Services* dialog box.
8. Exit the *Control Panel* program group.

NetDDE Setup

For Windows 95, no special setup is required.

For Windows NT, you must do the following:

1. From the **Start** menu, select **Settings**.
2. From the **Settings** menu, select **Control Panel**.
3. In the *Control Panel* program group, select **Services**.
4. In the *Services* dialog box, select the CIMPLICITY HMI service.
5. Select **Startup...**
6. In the *Service* dialog box:
   A. Set the **Log On As** field to **system account**.
   B. Enable the **Allow Service to Interact with Desktop** option.
   C. Select **OK** to close the *Service* dialog box and save your changes.
7. On the computer where the DDE Server is running, run **DDESHARE.EXE** (usually found in **\winnt35\system32\ddeshare.exe**).
   A. Select **DDE Shares** from the **Shares** menu.
   B. Add a new **Share** by creating a share name.
   C. Enter the DDE Server's Application Name and Topic into the **Old style**, **New style** and **Static** fields.
   D. Enable the **Allow start application** and **Is Service** option.
   E. Select **Permissions...**.
   F. Select **Everyone.**
   G. Set **Type of Access** to **Full Control**.
   H. Select **OK** to exit the **permission** and **DDE Share Properties**.

DDE Diagnostic Utility

The **dde_diag.exe** program, located in the CIMPLICITY HMI **\exe** directory, is provided to assist you in validating communication to a specific DDE Service, Topic and Item name. The Service and Topic name are used in the CIMPLICITY HMI device configuration and the Item name is used in the CIMPLICITY HMI point configuration.

This program is invoked by using one of the following commands:

- For read tests

  dde_diag.exe <service> <topic> <item>

- For write tests

  dde_diag.exe <service> <topic> <item> <type> <value>

- For HotLink tests

  dde_diag.exe <service> <topic> <item> OnChange

where :

<service> is the Application (or Service) name of the DDE Server.

<topic> is a valid Topic for the DDE Server.

<item> is a valid Item for the DDE Server (format is Server specific).

<type> is one of the following data types:

C - Character
S - Short
L - Long
F - Floating
T - Text

<value> is a valid value to be written to the item.

Note

HotLink means a *Hot Link* will be created for the given item. Once the link is established, the value of the item is updated automatically by the DDE Server.

Upon successful connection to the DDE Server for the given Topic, this test utility reads and prints the value of the given Item. An appropriate error message is printed if the utility fails to connect to the DDE server or the Item is invalid.

When validating communication over NetDDE, the Service is:

\\<nodename>\ndde$

where:

<nodename> is the computer name where the DDE Server is running.

The Topic is the Share Name you created using the DDE share utility.

DDE Application Configuration

As with other CIMPLICITY HMI Communication enablers, you must complete the Port, Device, and Device Point configuration to set up the DDE Client Communications enabler.

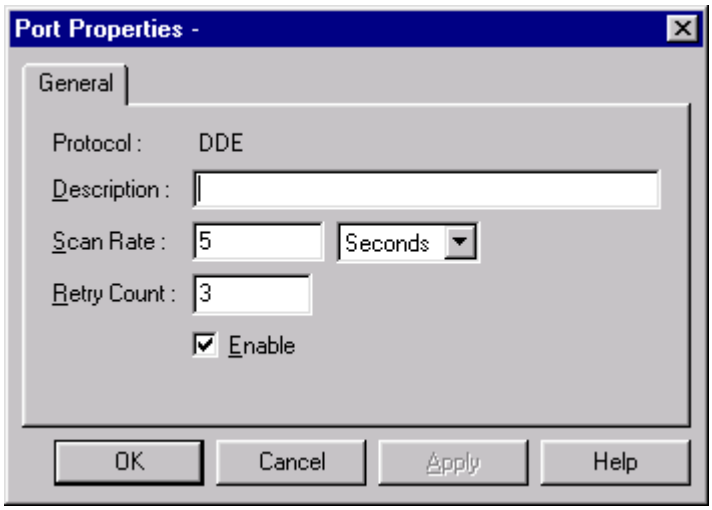
Port Configuration

When you configure a new port for DDE Client communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **DDE** from the list of protocols.
2. In the **Port** field, select the communication port that will be used for DDE Client communications.

When you select **OK** to create the port, the Port Properties dialog box for the protocol opens.

General Port Properties



Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description — Enter an optional description to help you identify the port.

Scan Rate — Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count — If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

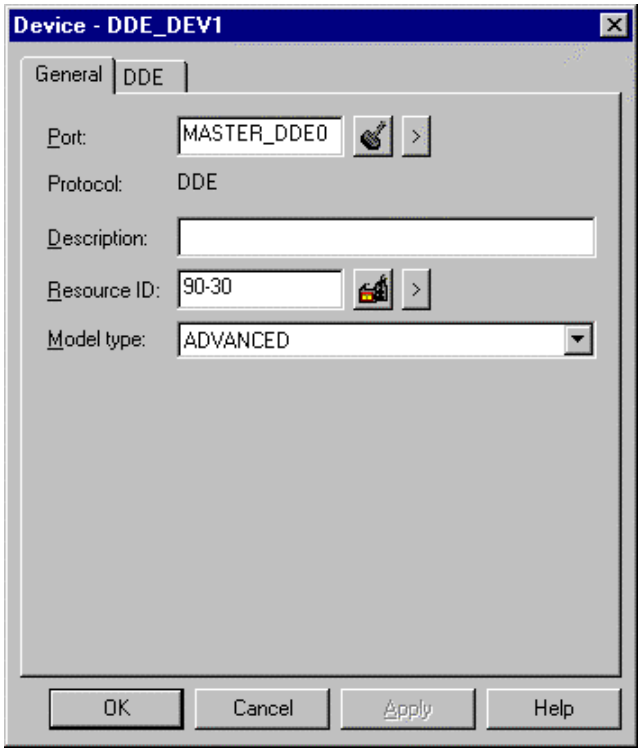
DDE Device Configuration

When you create a new device for DDE Client Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the DDE port to be used by the device.

When you select **OK** to create the port, the *Device Properties* dialog box opens.

General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource

Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type

Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection.

The choices are:

ADVANCED

DDE Client communications only communicates with the DDE Server using the AdvancedDDE format.

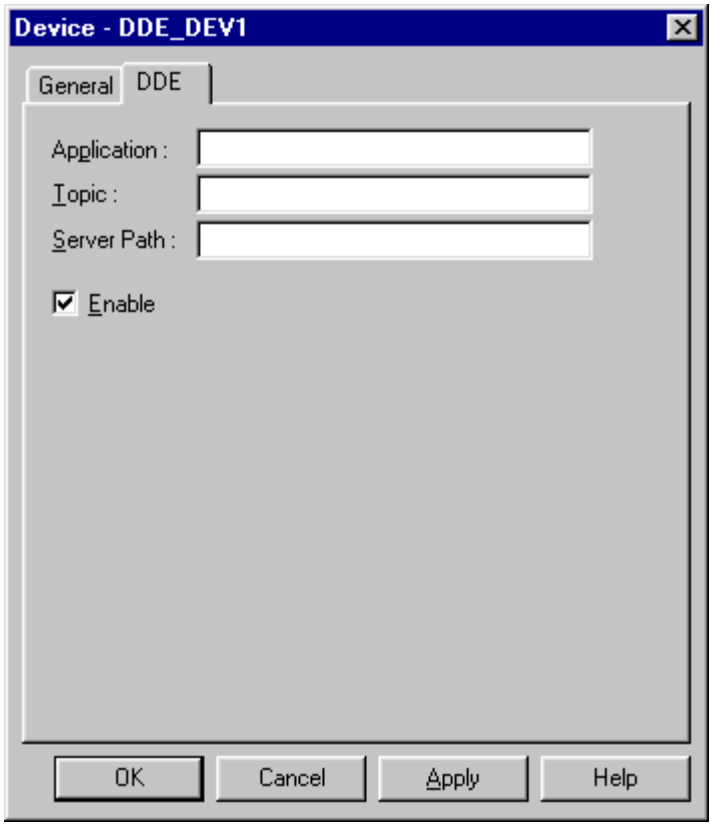
DEFAULT

DDE Client communications negotiates with the DDE Server to decide the format of the communication.

TEXT

DDE Client communications only communicates with the DDE Server using the TEXT format.

DDE Device Properties



When you configure a physical device for the DDE Client Communications enabler, use the *DDE* properties to enter information about DDE communications for the device. You can define the following:

Application Enter the Application name:

- For DDE communications, enter the Service Name of the DDE server.
- For NetDDE communications, enter **\\Nodename\ndde$**, where **Nodename** is the computer name where the DDE Server is running.

Topic Enter the Topic name:

- For DDE communications, enter the Topic Name that is configured for the specific DDE Server you are using.
- For NetDDE communication, enter the **DDE share name** created within the **ddeshare** utility.

Server Path Enter the full server executable name if the server should be started by the CIMPLICITY DDE Client Communications enabler.

- If you provide the executable name of the Server, the Enabler will start the server before attempting to connect to the Server.

If you do not provide the Server's executable path, you must start the Server independently and ensure the CIMPLICITY HMI project and the Server are running under the same USER_ID.

Enable Set this check box if you want the device to be enabled when the project starts. If you clear this check box, the device will not be enabled when the project starts, and points will not be available for this device.

Point Configuration

You can configure points that correspond to values in a physical device. The DDE Client communications enabler establishes a *Hot Link* to the DDE Server for all DDE points in your project configuration. For *Hot Link* Items, the Server provides an initial value, and then provides an update whenever the Item changes. However, the data is passed back to the Point Manager based on the update criteria you select for your DDE points.

When you define a point, the following fields have values that are unique to or have special meaning for DDE communications:

General Point Properties

On the General tab in the Point Properties dialog box, you may configure points for **Read** or **Read/Write** access.

Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria: The update criteria determines how the data will be requested. Click the drop-down button to the right of the input field to display your choices, then make a selection.

For device points–Select **Unsolicited** for the DDE Client communications to send data it receives to Point Management whether or not the point's value has changed..

For device points–Select **Unsolicited On Change** for the DDE Client communications to send data it receives to Point Management only if the point's value has changed.

For diagnostic points–Select **On Change** to have the DDE Client Communications poll the values at regular intervals and update only changed values.

For diagnostic points–Select **On Scan** to have the DDE Client communications poll and update the values at regular intervals, whether or not the values have changed.

For diagnostic points–Select **On Demand On Change** for the DDE Client Communications to poll values whenever they are needed by an application and to update only changed values.

For diagnostic points–Select **On Demand On Scan** for the DDE Client Communications to poll and update values when they are needed by an application whether or not the values have changed.

For device points–Select **On Demand Unsolicited.**

For device points–**Select On Demand Unsolicited On Change.**

Important: Device points that are configured with an update criteria other than Unsolicited or Unsolicited On Change will be found to be invalid. When using point by address, the point must be configured for an unsolicited update criteria.

Address: The general point address format is the format of the data item defined by the specific DDE server. See the DDE server documentation for the syntax of the data item.

Diagnostic Point Configuration

For some DDE Servers, there is no mechanism or event to determine when a device is disconnected (down). For this type of DDE Server, you can configure a diagnostic (heartbeat) point for each physical device with which the DDE Server is communicating. The DDE Client Communications enabler can then read the point and set the device down if the read fails. The diagnostic point can be configured as any point type with the following address format:

```
$HP <DDE_item_address>
```

where **<DDE_item_address>** is the point address to read from the DDE Server. The scan rate of the point will be used as the heartbeat interval for the device.

In addition, Device heartbeat points can be configured to specify that a device is available based on the value of a specified point. Previously, a diagnostic point with the address **$HP<addr>** would cause the device to be marked unavailable whenever the address **<addr>** could not be polled.

Using the new hearbeat point syntax, the device can be marked unavailable whenever the address **<addr>** does not have a specific value. For example, if the point **$HP_0<addr>** were configured, the device would only be available when **<addr>** could be read and contained the value 0.

Procedure for Enabling the Connection Reset Feature

You must perform the first two steps of the procedure to enable the Connection Reset feature. The third step is needed only when the DDE server does *not* respond to the disconnect request in a timely fashion.

To enable the Connection Reset feature:

1. Create the following **glb_parm** entry.

   DDE_RESET_ON_WRITE_FAILURE|1|Yes

   When the devcom forces the connection to be closed (instead of the server), a default mechanism is needed to determine when to reconnect.

2. Configure a heartbeat point to enable the default mechanism capability. *See "Diagnostic Point Configuration" above.*

   Configuring the heartbeat point will cause the connection to be automatically re-established.

3. Change the CPU_ID in the **device.idt** file as follows.

   bit 0 --> accept NULL value back from the DDE server

   bit 1 --> wait for 3 consecutive failure of heartbeat before marking device dead

   bit 3 --> For text heartbeat point we want to make sure that any Unsol. data coming after the Device Dead that has device dead string should not mark the device up.

   bit 4 --> Use "advised heartbeat point"

DDE Communications Limitations

You need to be aware of the following limitations for the DDE Client Communications enabler:

- The DDE Client Communications enabler does not support CIMPLICITY Array points (formats of array points vary between Servers), except for Text points.

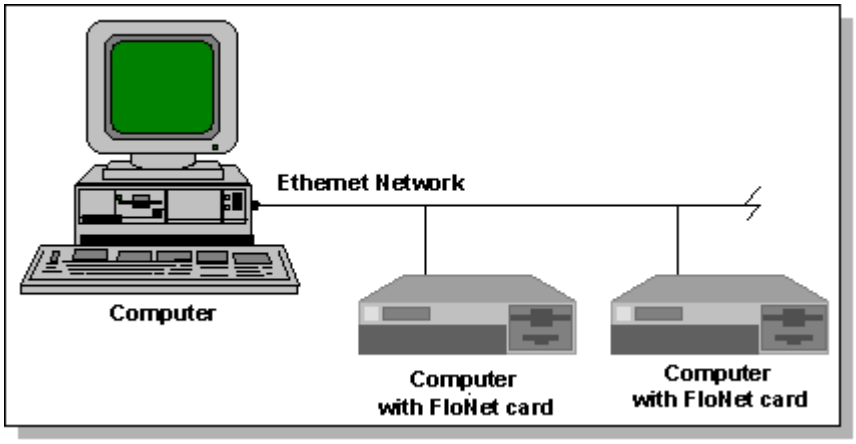
FloPro/FloNet Communications

About FloPro/FloNet Ethernet Device Communications

FloPro is a program that runs on IBM PC compatible computers and lets them perform functions similar to PLCs. FloPro can communicate with a host computer via a special interface card across 10/Base-T Ethernet physical interconnections. This card is referred to by its model number (IPN-200) or as a FloNet card. The physical network it communicates across may be referred to as the Ethernet or as FloNet.

The FloPro/FloNet Communications option and the FloNet cards communicate across a 10/Base-T Ethernet standard physical layer in loose compliance with the UDP/IP protocol standard. As noted in the *FloNet Specification for IPN-200 FloNet Interface Board* document, the FloNet card's flash ROM area holds all the firmware involved with network communications. FloPro itself merely polls the FloNet card to see if a command packet has arrived from a project on the CIMPLICITY HMI host computer.

The physical communications link between a CIMPLICITY HMI computer and the processors running FloPro is a 10 MHz Ethernet network with a twisted-pair connection to each FloNet card.



FloPro/FloNet Communications Features and Restrictions

The FloPro/FloNet Communications option provides the following features:

- Configuration functions for defining the devices accessed via the communication port and the data to be exchanged.
- Synchronous exchange of data between CIMPLICITY software and a variety of devices.
- A utility program, **`flopro_diag`**, which is used for validating the operation and communication ability of a FloNet device residing at one particular IP address.
- Since the FloPro/FloNet system accepts commands from any IP address and replies on a message-by-message basis, a CIMPLICITY HMI computer may converse with many FloPro devices over one FloPro dedicated network.

You need to be aware of the following restrictions:

- Because FloNet cards occupy and converse only with sockets bound to privileged IP port number 165, only one FloPro/FloNet Communications process can run on a CIMPLICITY HMI computer.
- Because FloNet cards cannot initiate communications with a remote host, the FloPro/FloNet device communications does not support unsolicited messages.
- Because FloPro/FloNet communications supports a subset of UDP, the FloPro card does *not* support the **`ping`** command.
- A dedicated network is required for communication between FloNet devices and their remote hosts.

FloPro/FloNet Communications Supported Devices

PCs equipped with FloNet cards running version 1.14 firmware, and FloPro version 2.774, including model/capacity variants FloPro/64, FloPro/256, FloPro/512, FloPro/1024, FloPro/4096 and FloPro/6144 are supported locally via an Ethernet link.

Note

The motion-control disabled variants have not been tested, but should operate identically, since the device communications module does not deal with the options of FloPro such as motion-control and RF scanner.

FloPro/FloNet Communications Supported Memory Types

For all FloPro versions, data can be read and written to the following data types:

Domain Name	Data Type	Direction (as seen by CIMPLICITY software)
Input	Digital	Read/Write
Output	Digital	Read/Write
Flag	Digital	Read/Write
Input Force	Digital	Read only
Output Force	Digital	Read only
Flag Force	Digital	Read only
Counter	16 bit signed	Read/Write
Register	4 digit unsigned BCD	Read/Write
Number	32 bit signed	Read/Write
ASCII	8 bit signed	Read/Write
Timer		
Limit	32 bit unsigned (10 ms increments)	Write only
Current value	32 bit unsigned (10 ms increments)	Read only

FloPro/FloNet Communications Related Documents

You should have the following documents on hand:

CIMPLICITY for Windows NT - Base System User's Manual (GFK-1180)

IPN-200 configuration Guide, Revision 1.0 - Diversified Technology, Inc.

FloNet Specification for IPN-200 FloNet Interface Board, Version 2.0 - Universal Automation, Inc.

Running the FloPro/FloNet Communications Test Program

To run the FloPro/FloNet communications test program to test your installation and configuration of FloPro on the target computer:

1. Open the project's *Configuration* cabinet.
2. From the **Tools** menu, select **Command Prompt...**.
3. In the *Command Prompt* window, type the following command:

   `flopro_diag [<address>]`

   where **`<address>`** is an optional argument and is the IP address of the target PC. If you do not supply this argument, the IP address defaults to 3.26.5.159.

When you run **`flopro_diag`** and select a nonexistent IP address or an IP address for a computer where FloPro is not configured, the output will show domain sizes of zero.

When you run **`flopro_diag`** for a target computer where FloPro is working correctly, it produces output like the following:

```
 Target is IP address 3.26.5.159
 Test to run 1 times
The Sockets DLL version is 1.1

 Examining domain limits database...
 For FloPro server at IP addr 9f051a03,
  limit[ 0]=4095    Input
  limit[ 1]=4095    Input Force
  limit[ 2]=4095    Flag
  limit[ 3]=4095    Flag Force
  limit[ 4]=1023    Timer
  limit[ 5]=2047    Counter
  limit[ 6]=1023    Register
  limit[ 7]=4095    Output
  limit[ 8]=4095    Output Force
  limit[ 9]=2047    Number
  limit[10]=2047    Ascii
```

FloPro/FloNet Communications Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to FloPro/FloNet communications.

FloPro/FloNet Communications Port Configuration

When you create a new port for FloPro/FloNet communications, enter the following information in the *New Port* dialog box:

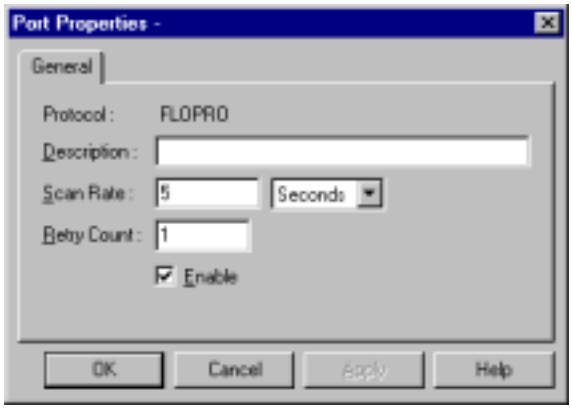
1. In the **Protocol** field, select **FLOPRO** from the list of available protocols
2. In the **Port** field, select that communication port that will be used for FloPro/FloNet communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

Note

Only one FloPro port is supported on a CIMPLICITY HMI computer.

General Port Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.
Retry Count	If communications cannot be established to a device on this port, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connection to it. Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.
Enable	Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

FloPro/FloNet Communications Device Configuration

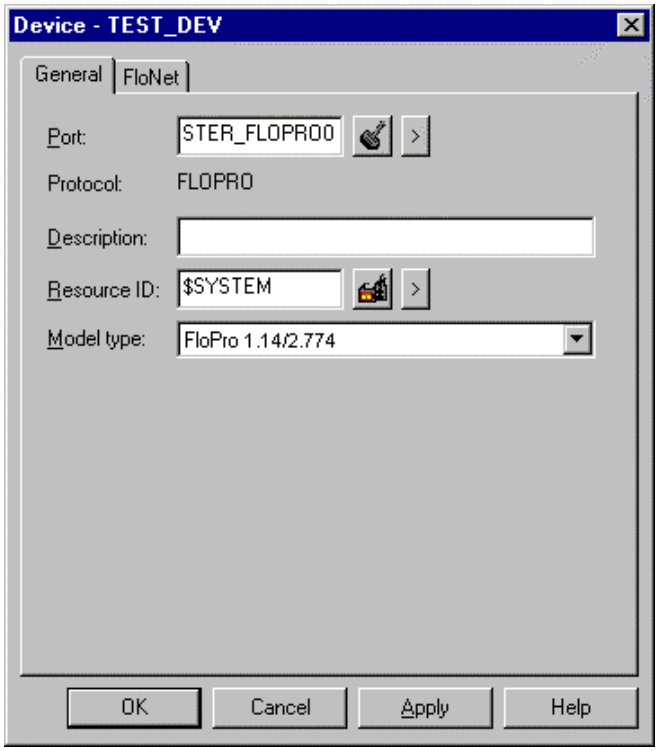
You must configure one device for each PC from which you will collect data using FloPro/FloNet communications.

When you create a new device for FloPro/FloNet communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the FloPro/FloNet port to be used by the device.

When you select **OK** to create the device, the *Device Properties* dialog box opens.

General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

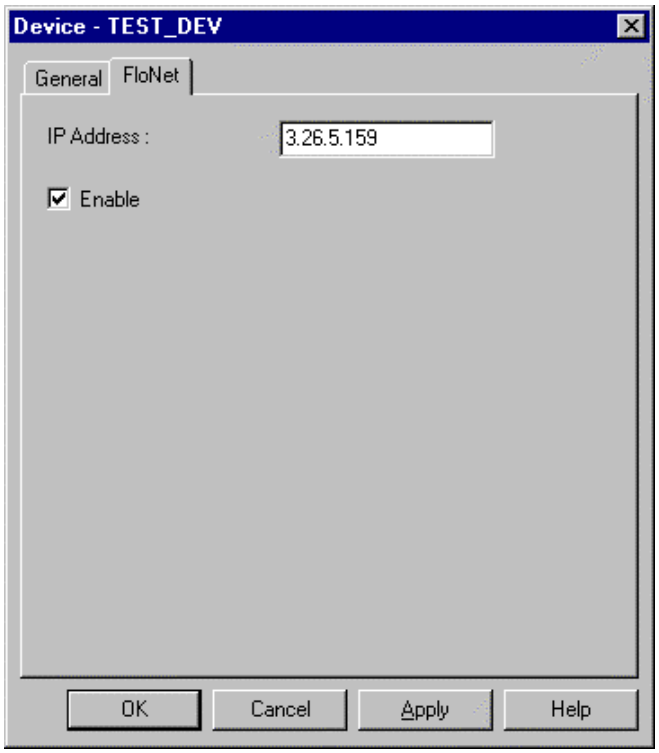
Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type The model type is FloPro 1.14/2.774

This model type supports PCs equipped with FloNet cards running version 1.14 firmware, and FloPro version 2.774.

FloNet Communications Device Properties



Use the FloNet tab in the Device dialog box to enter information about communications for the device. You can define the following:

IP Address	IP address of the target FloNet card in the FloPro PC.
Enable	Set this check box to enable the device when the project starts. If you clear this check box blank, the device will not be enabled and points associated with the device will be unavailable.

FloPro/FloNet Communications Point Configuration

Once your devices are configured, you may configure points for them. The fields described below have configuration values that are unique to or have special meaning to FloPro/FloNet Ethernet device communications.

General Point Properties

On the General tab in the Point Properties dialog box, the type of **Access** you choose depends on the point's data type.

- Select **Read** for Input Force, Output Force, Flag Force and Current Value points.
- Select **Read/Write** for Input, Output, Flag, Counter, Register, Number, ASCII and Timer Limit points.

Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria

The update criteria field determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by FloPro/FloNet communications at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by FloPro/FloNet communications at regular intervals while users are viewing them.

Address

A FloPro/FloNet device point address consists of a one or two character alphabetic field followed by an n-digit decimal-numeric field. The numeric field reflects the offset within an addressing domain, of the particular point. The alphabetic fields map to domains according to the following table:

Enter the point address as follows:

Data Type	Address format
Input	**I***n*
Input Force	**If***n*
Output	**O***n*
Output Force	**Of***n*
Flag	**F***n*
Flag Force	**FF***n*
Timer	**T***n*
Counter	**C***n*
Register	**R***n*
Number	**N***n*
ASCII	**A***n*

Advanced Configuration Requirements

In most cases, the standard startup procedure and response timeout are acceptable. For those cases where they are not, you can use the following global parameters to modify them.

FLOPRO_STATIC_MODEL

By default, when the FloPro/FloNet communications process starts, it queries all the FloPro/FloNet devices to find the maximum file size for each file type. If you have many FloPro/FloNet devices configured in the project, this can take considerable time, and slows project startup.

You can configure the global parameter FLOPRO_STATIC_MODEL to disable the queries. If this parameter is set to TRUE, the communications process uses the default sizes for all memory types. The default sizes are:

File Type	Size
Input	4095
Input Force	4095
Flag	4095
Flag Force	4095
Timer	1023
Counter	2047
Register	1023
Output	4095
Output Force	4095
Number	2047
ASCII	2047

If you set the parameter to FALSE or delete it, the default startup behavior is restored.

To change the startup behavior, add the following line to the global parameter file:

```
FLOPRO_STATIC_MODEL|1|<value>
```

where **<value>** is one of the following:

TRUE = Use the default memory sizes

FALSE = Query each device to find memory sizes

FLOPRO_RESPONSE_TIMEOUT

By default, the FloPro/FloNet communications process waits 10 milliseconds before reading the response from the PLC. You can use the FLOPRO_RESPONSE_TIMEOUT to increase or decrease this timeout.

To change the response timeout, add the following to the global parameter file:

FLOPRO_RESPONSE_TIMEOUT|1|<timeout>

where **<timeout>** is a value in milliseconds between 1 and 1000.

For example,

FLOPRO_RESPONSE_TIMEOUT|1|100

sets the response timeout to 100 milliseconds.

DC_RETRY_ONE_DEVICE

By default, the FloPro/FloNet communications process tries all down devices at each retry interval. You can use the DC_RETRY_ONE_DEVICE to Implement Alternate Retry Method for Down Devices.

If the global parameter DC_RETRY_ONE_DEVICE is set to TRUE, the devcom will retry only one device per retry interval. The “down” devices are retried in a “Round Robin” fashion (at the first Retry interval, the first “down” device is retried, at the next interval, the next down device is retried, etc). This is useful when many enabled devices are “down”, since the elapsed time for a retry interval is reduced. Without this parameter, the Devcom will retry all “down” devices each time the Retry interval expires. SPR 40994.

To set the global parameter to TRUE use:

DC_RETRY_ONE_DEVICE|1|TRUE

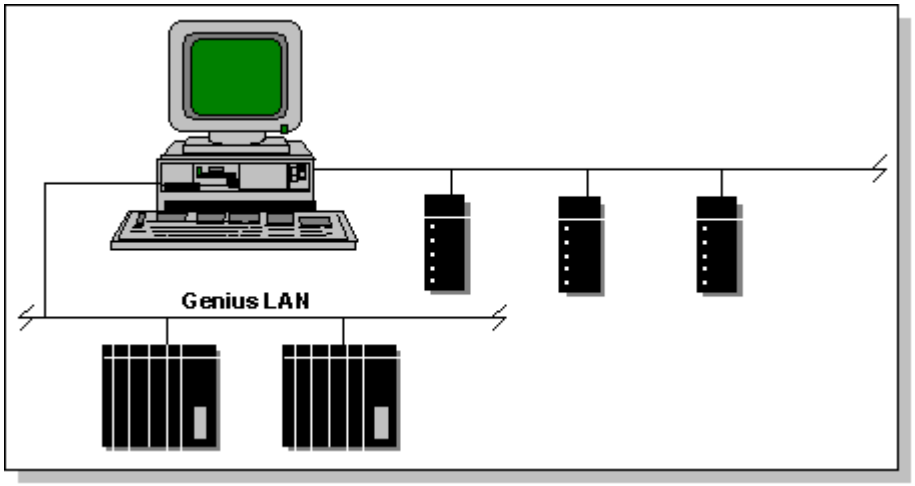
Genius Communications

About Genius Communications

The Genius® Communications enabler supports communications over a high-speed Genius LAN to Series 90™-70, Series 90-30 and Series Six™ programmable controllers, Genius Blocks, Genius Bus Interface Units (also called BIU or Field Control), and other computers with PCIM cards.

The driver is available for use on Intel based PCs running Windows NT or Windows 95 with the IC660ELB921, IC660ELB922 and IC660ELB906 PCIM cards.

You may have up to four Genius ports (called PCIM0, PCIM1, PCIM2 and PCIM3) on your computer.



This enabler supports the following CIMPLICITY HMI features:

- Polled read at user-defined rates
- Poll after setpoint
- Triggered reads
- Unsolicited data
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following CIMPLICITY HMI data types:

- Signed 8, 16, and 32 bit integer
- Unsigned 8, 16, and 32 bit integer
- Floating point
- Text
- Arrays

Supported Genius Devices

The Genius Communications enabler currently supports the following devices:

For datagram communications

- Series 90-70 programmable controllers with Genius Bus Controller
- Series 90-30 programmable controllers with Genius Bus Controller
- Series Six programmable controllers with Genius Bus Controller

For global data communications

- Series 90-70 programmable controllers with Genius Bus Controller
- Series 90-30 programmable controllers with Genius Bus Controller
- Series Six programmable controllers with Genius Bus Controller
- Genius Analog and Digital Blocks
- Genius Bus Interface Units (BIUs)
- Other PCIM cards on the network that are broadcasting global data

For fault data

- 115 VAC 4 In/2 Out Analog Blocks (IC660BBA100)
- 24/48 VDC 16 Circuit Sink I/O Digital Blocks (IC660BBD020)

Supported Genius Memory Types

The Genius Communications Enabler supports:

- Reading and writing point data to Series 90-70, Series 90-30 and Series Six programmable controllers via Datagram and Global communications
- Reading and writing point data to Series 90-70, Series 90-30, Series Six, Analog and Digital Genius blocks, Genius Bus Interface Units and other PCIM cards via Global communications.

Note

If you add a block to a programmable controller, reconfigure a Bus Interface Unit's bus map, or resize domains, you must stop and restart the Genius Communications Enabler in order for it to see the changes.

Series 90 Datagram Communications

Data may be read from or written to, and unsolicited datagrams may be received from the following memory types using Datagram communications:

Memory Type	Description
%AI	Analog Input Table
%AQ	Analog Output Table
%I	Discrete Input Table
%Q	Discrete Output Table
%R	Register Memory
%M	Discrete Momentary Internals
%S	System Fault Table
%SA	Special Contacts A
%SB	Special Contacts B
%SC	Special Contacts C

Do not write data to the system registers (%S, %SA, %SB, and %SC). Doing so may interfere with the normal operation of the programmable controller.

Series Six Datagram Communications

Data may be read from or written to, and unsolicited datagrams may be received from the following memory types using Datagram communications:

Memory Type	Description
R	Register Memory
I	Input Table
Q	Output Table

Block Datagram Communications

Fault data may be read from the following memory type on 24/48 VDC 16 Circuit Sink I/O Blocks (IC660BBD020) and 115 VAC 4 In/2 Out Analog Blocks (IC660BBA100):

Memory Type	Description
%GD	Read Block Level diagnostics

Block inputs and directed outputs are referenced as Global data. See the following section.

Global Communications

Data may be read from or written to the following memory types using Global data communications:

Memory Type	Description
%I	Read discrete inputs from Genius BIU
%AI	Read analog inputs from Genius BIU *
%Q	Write discrete outputs to the Genius BIU Discrete Output table
%AQ	Write analog outputs to the Genius BIU Discrete Output table *
%GL	Read Global Data from Analog and Digital blocks Read Global Data from programmable controllers Write Outputs to Digital Blocks Read Global Data from other Genius devices (such as PCIM cards)
%EO	Enable Outputs to Blocks Enable Outputs to Genius BIU
%DO	Directed Outputs to Analog Blocks

* Analog points configured in Discrete memory on a BIU must be configured to start on even-byte boundaries.

Special Note for Genius Bus Interface Units

For **%Q** and **%AQ** values, the actual output values will match the values displayed by your CIMPLICITY HMI project if and only if the BIU's outputs are controlled by the CIMPLICITY Genius Communications driver and the outputs are not otherwise forced.

Special Note for Directed Outputs to Analog Blocks

For **%DO** values, the actual output values will match the values displayed by your CIMPLICITY HMI project if and only if the Analog Block's outputs are controlled by the CIMPLICITY Genius Communications driver and the outputs are not otherwise forced.

Genius Hardware Configuration Requirements

Target Series 90-70, Series 90-30 and Series Six programmable controllers require the following:

A Genius Bus Controller

Personal computers running CIMPLICITY HMI Software and the Genius Communications Enabler require one or more of IC660ELB921, IC660ELB922 and IC660ELB906 PCIM cards.

You can read fault data from:

24/48 VDC 16 Circuit Sink I/O Block - Phase B IC660BBD020
115 VAC 4 In/2 Out Analog Block - Phase B IC660BBA100

If you are using Genius Communications with a Series Six, you must add an idle DPREQ to the ladder logic. For more information, see the *Series Six Bus Controller User's Manual* (GFK-0171).

Genius Related Documents

Refer to one or more of the following documents when configuring your communications network:

Single Slot PC Interface Module (PCIM) User's Manual (GFK-0881)

Genius I/O PCIM User's Manual (GFK-0074)

Series 90-70 PLC Genius Bus Controller User's Manual (GFK-0398)

Series 90-30 Genius Communications Module User's Manual (GFK-0412)

Series Six Bus Controller User's Manual (GFK-0171)

Genius I/O System and Communications User's Manual - Volume 1 (GEK-90486-1)

Genius I/O Discrete and Analog Blocks User's Manual - Volume 2 (GEK-90486-2)

IC660ELB906 PCIM DIP Switch Settings

When you use the IC660ELB906 PCIM card, you must set the I/O address, Interrupt address, and starting memory address for the card in DIP switches on the motherboard. There are three utilities you can use to help you set these DIP switches. They are:

- **pcim_iosw**
- **pcim_intsw**
- **pcim_memsw**

These utilities are located in CIMPLICITY HMI software's **\exe** directory, and you can run them from a command prompt.

You must also set DIP switches on the daughterboard to configure the Serial Bus Address, baud rate and output mode for the channel.

PCIM Motherboard Switch Settings

PCIM I/O Address

On the PCIM motherboard, you use Switch 1 to configure the I/O base address for the PCIM card. This setting determines the port address that the PCIM card uses to communicate with the Genius Communications Enabler.

The port occupies 4 contiguous bytes of I/O space and must be chosen so that it does not conflict with other devices installed in the computer. Examples of other devices are serial and parallel ports, video cards and Ethernet cards.

You can use the **pcim_iosw** utility to display the proposed switch settings for your I/O address. To run the utility, enter the following command:

```
pcim_iosw <number>
```

where **<number>** is the hexadecimal address of the starting byte for the I/O address in the I/O space. The utility then displays the switch settings for this address. You can then manually set the switches according to the display.

For example, entering

```
pcim_iosw 3e0
```

generates this output:

```
          SW1
 ON
/1 2 3 4 5 6 7 8\
 ! ! ! ! ! ! ! !
 C C C O O O O O
```

PCIM IRQ Level

On the PCIM motherboard, you use Switch 4 to configure the Interrupt address (or (IRQ level) for the PCIM card. This setting determines the interrupt that the PCIM card uses to communicate with the Genius Communications Enabler.

You must select a value that does not conflict with other devices currently installed and used on the computer.

Note

IRQ 2 is *not* available for computers running CIMPLICITY HMI software. While different computes and cards may be configured in many ways, some typical configurations include the following:

IRQ 3 - COM2
IRQ 4 - COM1
IRQ 5 - Network card
IRQ 6 - Floppy drive

You can use the **pcim_intsw** utility to display the proposed switch settings for your IRQ level. To run the utility, enter the following command:

```
pcim_intsw <number>
```

where **<number>** is the IRQ level you plan to use. The utility then displays the switch settings for this number. You can then manually set the switches according to the display.

For example, entering

```
pcim_intsw 4
```

generates this output:

```
          SW4
 ___________________
/1  2  3  4  5  6\
 |  |  |  |  |  |
 0  0  0  C  0  X
```

Note

The actual switch has 8 settings and supports IRQ 3-6, 10, and 11.
For IRQ 10, the settings are:

1 2 3 4 5 6 7 8
0 0 0 0 0 X O C

For IRQ 11, the settings are:

1 2 3 4 5 6 7 8
0 0 0 0 0 X C O

PCIM Host Memory Address

On the PCIM motherboard, you use Switches 2 and 3 to configure the starting address on a 16 KB buffer in the host computer's memory. The PCIM uses this buffer to store I/O data buffers for communication data and other information used by PCIM.

In order for the PCIM card to operate successfully with CIMPLICITY HMI software, you must select a starting address between 640 KB and 1 MB, and you must make sure that the first switch on Switch 3 is *closed*. Be sure to check the memory map for the computer where you are installing the PCIM to ensure that there are no conflicts with other devices in this memory range.

Note

The Genius Communications Enabler cannot be reliably used in systems that use external memory caching hardware. If your computer is using external memory caching, you must be able to *not* cache the shared memory addresses. If you cannot do this, changes to device data initiated by bus devices may not be detected.

You can use the **pcim_memsw** utility to display the proposed switch settings for your memory address. To run the utility, enter the following command:

```
pcim_memsw <number>
```

where **<number>** is the hexadecimal starting address of the I/O data buffer. The utility then displays the switch settings for this address. You can then manually set the switches according to the display.

For example, entering

```
pcim_memsw e4000
```

generates this output:

```
      SW2
    ,-------.
   /1 2 3 4 5 6\
    | | | | | |
    O C C O O O

      SW3
    ,-------.
   /1 2 3 4 5 6\
    | | | | | |
    C X C C C C
```

PCIM Daughterboard Switch Settings

Use Switch 4 on the daughterboard to set the Serial Bus Address, baud rate, and output mode for the PCIM.

PCIM Serial Bus Address

Use bits 1-5 to set the Serial Bus Address. Valid addresses are:

SBA	1	2	3	4	5	SBA	1	2	3	4	5
0 *	C	C	C	C	C	**16**	C	C	C	C	O
1	O	C	C	C	C	**17**	O	C	C	C	O
2	C	O	C	C	C	**18**	C	O	C	C	O
3	O	O	C	C	C	**19**	O	O	C	C	O
4	C	C	O	C	C	**20**	C	C	O	C	O
5	O	C	O	C	C	**21**	O	C	O	C	O
6	C	O	O	C	C	**22**	C	O	O	C	O
7	O	O	O	C	C	**23**	O	O	O	C	O
8	C	C	C	O	C	**24**	C	C	C	O	O
9	O	C	C	O	C	**25**	O	C	C	O	O
10	C	O	C	O	C	**26**	C	O	C	O	O
11	O	O	C	O	C	**27**	O	O	C	O	O
12	C	C	O	O	C	**28**	C	C	O	O	O
13	O	C	O	O	C	**29**	O	C	O	O	O
14	C	O	O	O	C	**30 ***	C	O	O	O	O
15	O	O	O	O	C	**31 ***	O	O	O	O	O

* Bus addresses 30 and 31 are not recommended for the PCIM. They are used by bus controllers in redundancy mode. In addition, Bus address 0 is used by convention for the Hand Held Monitor.

PCIM Baud Rate

Use bits 6-7 to set the baud rate. Valid baud rates are:

Baud Rate	6	7
153.6 EXT	C	C
38.4 KB	O	C
76.8 KB	C	O
153.6 STD *	O	O

* Recommended setting

PCIM Output Mode

Use bit 8 to set the output mode. Valid output modes are:

Mode	8
Enable	C
Disable **	O

** Required setting

PCIM Card Installation Procedures

You can use the Genius Communications enabler with IC660ELB921, IC660ELB922 and IC660ELB906 PCIM cards. Because you configure the IC660ELB921 and IC660ELB922 PCIM card in software and IC660ELB906 PCIM card in hardware, the installation procedure for each card is different. Be sure to follow the steps for the card you are installing.

IC660ELB921 or IC660ELB922 PCIM Card

To install and configure an IC660ELB921 or IC660ELB922 PCIM card, follow this procedure:

1. Install CIMPLICITY HMI software.
2. Determine the interrupt, I/O address, and memory address that are available for use in your computer. On Windows NT systems, you can review the system configuration with the NT Diagnostics application, which is found in Administrative Tools.

Note

On some PCI Bus systems, it is necessary to configure the BIOS for the use of shared memory by ISA cards. Refer to your system's manual for details. The Genius Configuration application cannot detect a problem when this situation occurs.

3. Set the Master Port Address dip switches on the PCIM card. In many cases, the default I/O address of 222 will be compatible with your system.
4. Shutdown your computer and install the PCIM card(s).
5. Restart your computer.
6. Run the PCIM Configuration application and set the Interrupt, I/O Address, and Shared Memory addresses as desired. If you are using more than a single Genius channel, note the following requirements:
   - All channels on all cards should share a single interrupt.
   - All PCIM cards must have a unique Master Port I/O Address setting.
   - All PCIM channels must have unique I/O and Memory address settings.

   It is recommended that Disable Outputs and Disable Watchdog Timer be checked.
7. Connect the PCIM to supported devices over a Genius network and verify communications using the PCIM Link application.

IC660ELB906 PCIM Card

To install and configure an IC660ELB906 PCIM card, follow this procedure:

1. Install CIMPLICITY HMI software.
2. Determine the interrupt, I/O address, and memory address that are available for use in your computer. On Windows NT systems, you can review the system configuration with the NT Diagnostics application, which is found in Administrative Tools.

Note

On some PCI Bus systems, it is necessary to configure the BIOS for the use of shared memory by ISA cards. Refer to your system's manual for details. The Genius Configuration application cannot detect a problem when this situation occurs.

3. Set the DIP switches for I/O, Memory, Interrupt Level and Serial Bus Address on the PCIM card. You can use the **`pcim_iosw`**, **`pcim_intsw`**, and **`pcim_memsw`** utilities to find out how switches should be set for the configuration you want.
4. Shutdown your computer and install the PCIM card(s).
5. Restart your computer.
6. Run the PCIM Configuration application and set the Interrupt, I/O Address, and Shared Memory addresses to match your card configuration.

   If you are using more than a single Genius channel, note the following requirements:

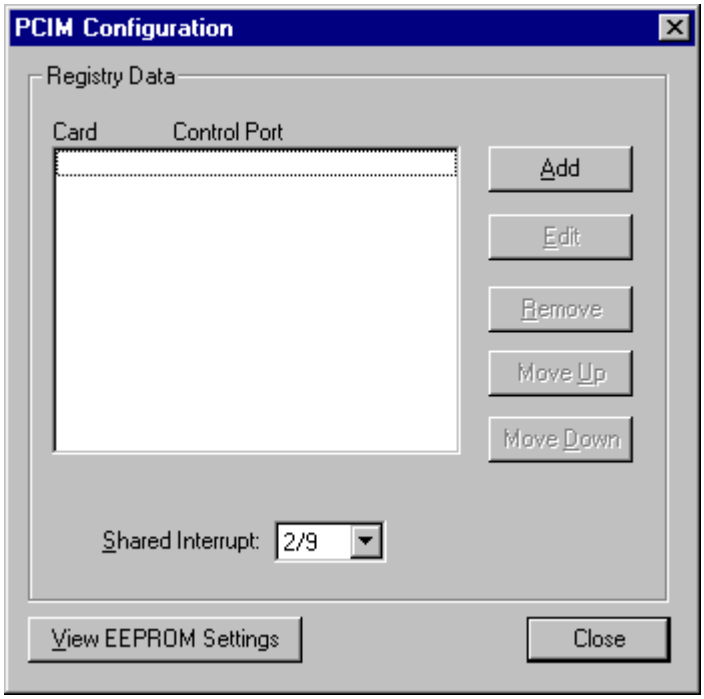
   - All channels on all cards should share a single interrupt.
   - Each port must have a unique address.
   - All PCIM channels must have unique I/O and Memory address settings.

   It is recommended that Disable Outputs and Disable Watchdog Timer be checked.
7. Connect the PCIM to supported devices over a Genius network and verify communications using the PCIM Link application.

PCIM Configuration Application

You configure the PCIM hardware and the Windows NT operating system using the PCIM Configuration application. To run PCIM Configuration, select the *PCIM Configuration* icon in the CIMPLICITY HMI program group.

The *PCIM Configuration* dialog box opens.



You can use the dialog to

- Select the shared interrupt for the PCIM cards.
- Add a new PCIM card to the list.
- Configure a PCIM card.
- Remove a PCIM card from the list.
- Reorder the list of PCIM cards.
- Change the master port address.

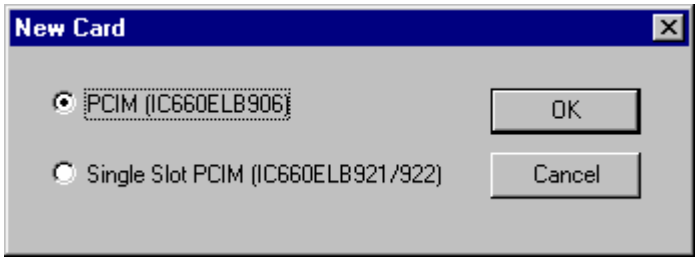
When the application is run for the first time, the list box will be blank.

Setting the Shared Interrupt

All channels on all PCIM cards used by your system must share the same interrupt. To configure the interrupt, click the drop-down list button to the right of the **Shared Interrupt** field on the *PCIM Configuration* dialog box and select the interrupt you want to use.

Adding A PCIM Card

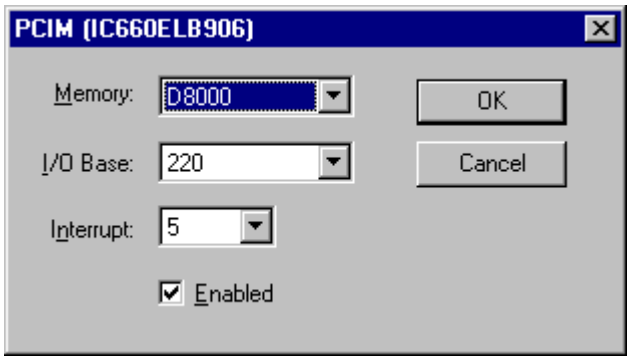
When you select **Add** or press **Alt+A**, the *New Card* dialog box opens.



Select the type of PCIM card you are configuring, then select **OK**. The next dialog box that opens depends on the type of PCIM card you select here.

Adding an IC660ELB906 PCIM

When you select **PCIM (IC660ELB906)**, then select **OK**, the *PCIM (IC660ELB906)* dialog box opens.



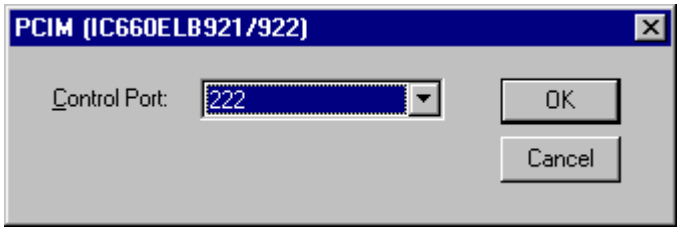
For an IC660ELB906 PCIM card, enter the following information:

Memory	Enter the memory address you configured in the DIP switches on the motherboard.
I/O Base	Enter the I/O Base Address you configured in the DIP switches on the motherboard.
Interrupt	Enter the Interrupt you configured in the DIP switches on the motherboard.
Enabled	Set this check box to enable the PCIM card.

To have your input accepted, select **OK** or press **Enter**. The *PCIM (IC660ELB906)* dialog box closes, and the list box in the *PCIM Configuration* dialog box updates to reflect your changes.

Adding a IC660ELB921 or IC660ELB922 PCIM

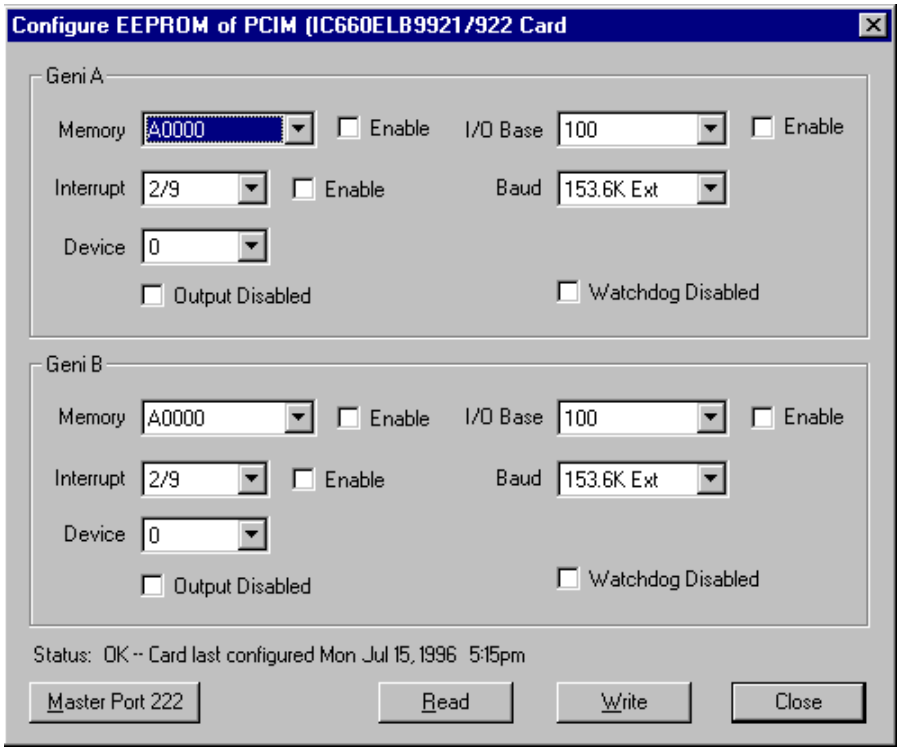
When you select **Single Slot PCIM (IC660ELB921/922)**, then select **OK**, the *PCIM (IC660ELB921/922)* dialog box opens.



Type in or select the **Control Port Address** from the drop down box. This address must match the Master Port Address configured in the DIP switches for the PCIM card. To have your input accepted, select **OK** or press **Enter**. The *PCIM (IC660ELB921/922)* dialog box closes, and the list box in the *PCIM Configuration* dialog box updates to reflect your changes.

Configuring an IC660ELB921 or IC660ELB922 PCIM Card

To configure an IC660ELB921 or IC660ELB922 PCIM card, select it from the list, then select **View EEPROM Settings** or press **Alt+V**. The *Configure EEPROM of PCIM (IC660ELB921/922) Card* dialog box opens with the current values configured for the PCIM card.



Enter the following for each Genius channel on the card.

- For IC660ELB921 enter the data for Module 0 only.
- For IC660ELB922 enter the data for either or both Module 0 and Module 1.

Memory	Enter the shared memory address to be used by the card.
Memory Enable	Set this check box to enable shared memory for this channel.
Interrupt	Enter the Interrupt Request number to be used by the card. This number must be the same for all cards and modules when used with CIMPLICITY software.
Interrupt Enable	Set this check box to enable this channel.
Device	Enter the Bus Address for the Genius channel.
I/O Base	Enter the I/O Address for the Genius channel.
I/O Base Enable	Set in this check box to enable this channel.
Baud	Enter the Baud Rate for the Genius channel
Output Disabled	Set this check box to disable Outputs as the default when the PCIM is enabled.
Watchdog Disabled	Set this check box to disable the watchdog timer (required).

After you enter your changes, select **Write** or press **Alt+W** to write the new configuration to the PCIM card.

You can also:

- Select **Master Port** or press **Alt+M** to change the Master Port Address for this card.
- Select **Read** or press **Alt+R** to read the current configuration for this card.

Select **Close** or press **Esc** when you have completed your configuration changes. The dialog box closes and the *PCIM Configuration* dialog box redisplays.

Note

When you close the dialog, changes that you have made are *not* automatically saved. You *must* select **Write** or press **Alt+W** to save your changes and write the new configuration to the PCIM card.

Removing A PCIM Card

For each card that you want to remove from the configuration:

1. Select the card from the list on the *PCIM Configuration* dialog box.
2. Select **Remove**.

When you are done, select **Close** to save your changes.

Reordering the PCIM Card List

For each card that you want to reorder in the list of PCIM cards:

1. Select the card from the list on the *PCIM Configuration* dialog box.
2. Select **Move Up** to move the card up in the list or **Move Down** to move the card down in the list.

When you are done, select **Close** to save your changes.

Changing A Master Port Address

If you need to change the Master Port Address for an IC660ELB921 or IC660ELB922 PCIM card:

1. Select the PCIM card from the list on the *PCIM Configuration* dialog.
2. Select **Change**.
3. When the *PCIM (IC660ELB921/922)* dialog opens, enter the new address in the **Master Port Address** field.
4. Select **OK** or press **Enter**.

The new Master Port Address appears in the *PCIM Configuration* dialog box when it redisplays.

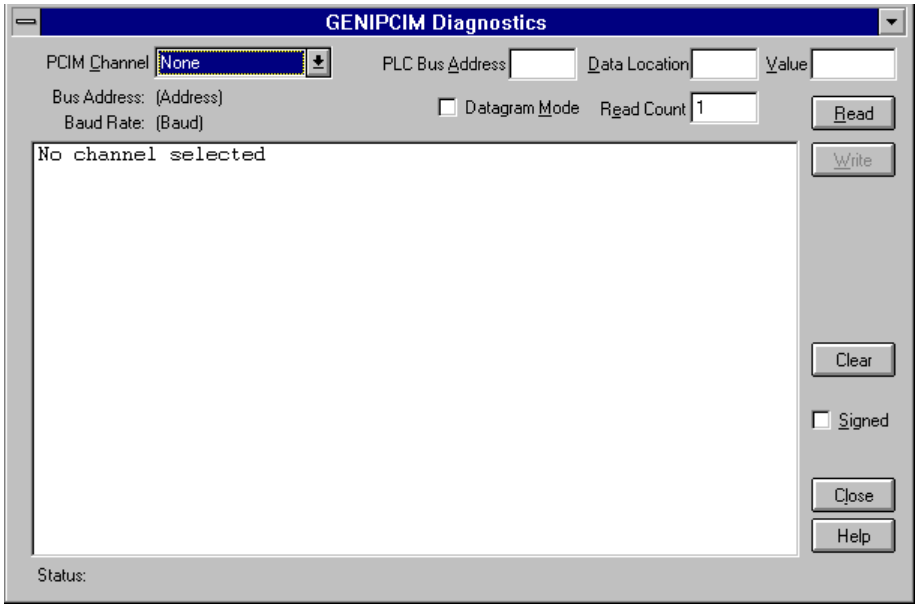
Genius Link Application

The CIMPLICITY Genius Link application lets you verify that you can communicate with other devices on your Genius network. Using Genius Link you can:

- View the devices and the global data that is being broadcast on your Genius network.
- Read data via Datagrams from a programmable controller.
- Write data to the programmable controller via Datagrams.

To run the Genius Link, double-click on the *Genius Link* icon in the CIMPLICITY HMI program group.

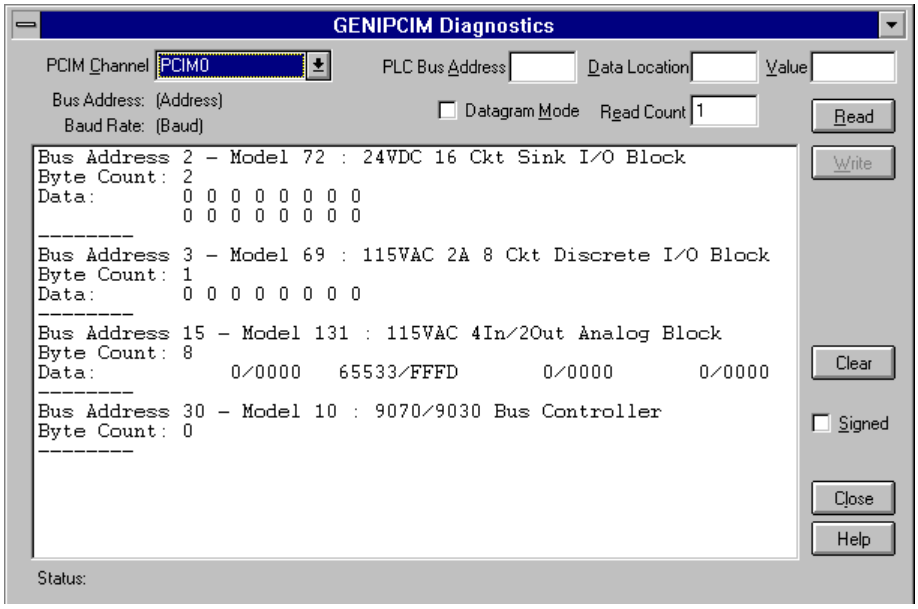
The *GENIPCIM Diagnostics* dialog box opens.



To select a PCIM channel, click on the drop-down list button to the right of the **PCIM Channel** input field, or press **Alt+C**. The first (top) channel of the first card will be PCIM0 and next is PCIM1.

Reading Global Data

Once you select a channel, the display changes to show the devices on the bus, the data that is being broadcast as global data, and the total length of the data.


GENIPCIM Diagnostics
PCIM Channel
PCIM0
PLC Bus Address
Data Location
Value
Bus Address: (Address)
Baud Rate: (Baud)
Datagram Mode
Read Count
1
Read
Write
Bus Address 2 - Model 72 : 24VDC 16 Ckt Sink I/O Block
Byte Count: 2
Data: 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
Bus Address 3 - Model 69 : 115VAC 2A 8 Ckt Discrete I/O Block
Byte Count: 1
Data: 0 0 0 0 0 0 0 0
Bus Address 15 - Model 131 : 115VAC 4In/2Out Analog Block
Byte Count: 8
Data: 0/0000 65533/FFFD 0/0000 0/0000
Bus Address 30 - Model 10 : 9070/9030 Bus Controller
Byte Count: 0
Clear
Signed
Close
Help
Status:

Reading and Writing Datagram Data

To read and write data to Series 90 programmable controllers on the bus, set the **Datagram Mode** check box or type **Alt+M**. Then fill in the following fields:

PLC Bus Address

Enter the Genius Bus Address for the Series 90 or Series Six programmable controller that is the target for communications.

Data Location

Enter the address for the data you want to read or write (for example, %R10 for register 10 or %I22 for input 22).

Supported Data Locations for Series 90 are:

%R, %I, %Q, %AI, %AQ, %M, %S, %SA, %SB, %SC

Caution

Do not write data to the system registers (%S, %SA, %SB, and %SC). Doing so may interfere with the normal operation of the programmable controller.

Supported Data Locations for Series Six are:

R, I, O

Important

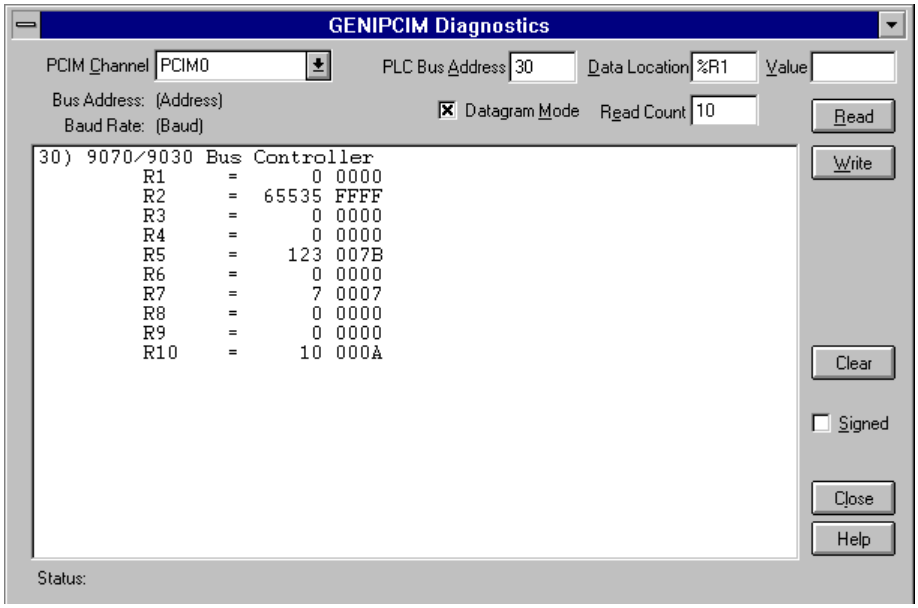
Outputs are %O for *GENIPCIM Diagnostics* only. They are %Q for normal communications.

Read Count	Enter the number of data elements you want to read. The maximum length of the data that can be read at one time is 128 bytes: 64 Registers or 1024 Bits from inputs and outputs.
Value	Enter the data value to be written to the specified Data Location. Only one data element is written at a time (one register or one input/output bit).

You can now do one of the following:

- Select **Read** or type **Alt+R** to initiate a read of the data.
- Select **Write** or type **Alt+W** to write a value.

When data is read, the dialog box changes to display the data.



At this point, you can do any of the following:

- Set the **Signed** check box or type **Alt+S** to view data as signed integers.
- Select **Clear** to clear data from the dialog box.
- Select **Close** to exit.

About Genius Application Configuration

When you configure ports, devices, and device points, you will need to enter some data that is specific to Genius communications. The following sections review the configuration requirements.

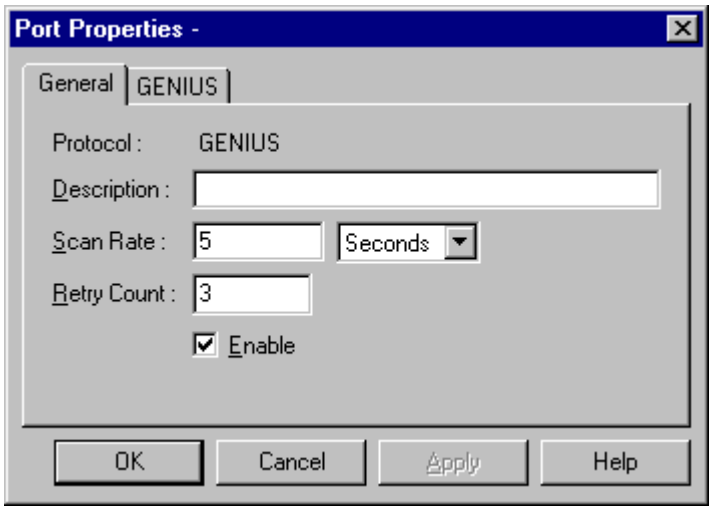
Genius Port Configuration

When you configure a port for Genius Communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **GENIUS** from the list of available protocols.
2. In the **Port** field, select the PCIM port that will be used for Genius communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

Genius General Port Properties

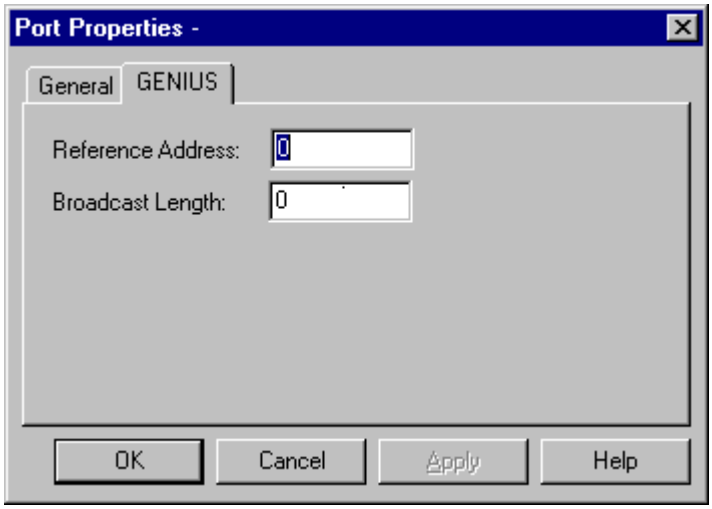


Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.
Retry Count	If communications cannot be established, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it. Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.

Enable Set this check box if you want the port to be enabled. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Genius Port Properties



You only need to access the Genius tab in the Port Properties dialog box if you intend to broadcast Global Data. For more information on broadcasting Global Data, see "PCIM Port Global Data Broadcast".

Use the *Genius* property page to define the following:

Reference Address The starting address of Global data for Series Six PLCs in the Genius network.

Broadcast Length The length, in bytes, for outgoing Global Data from this computer to devices in the Genius network.

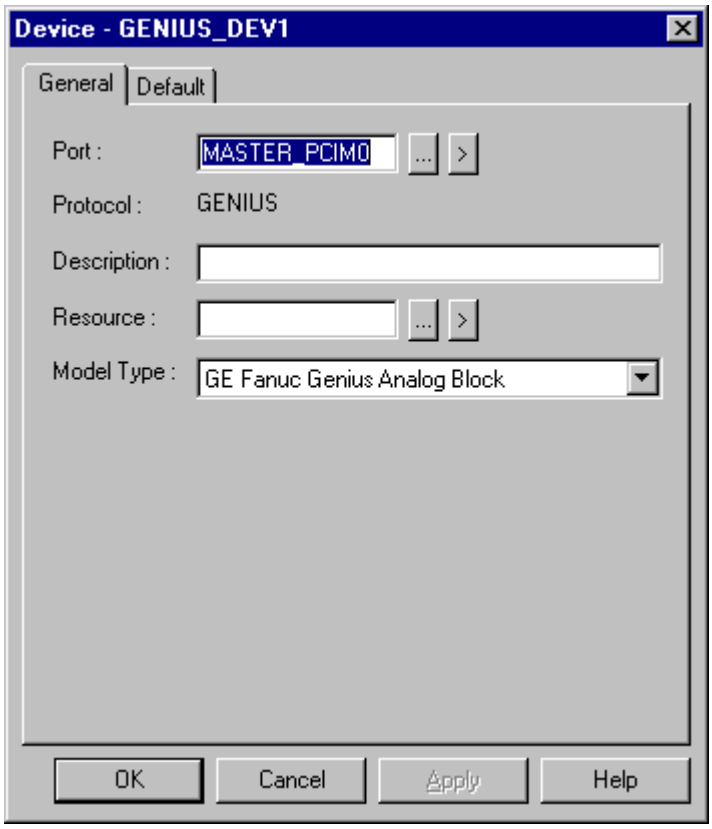
Genius Device Configuration

When you create a device (a programmable controller or Genius Block) for Genius Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Genius port to be used by the device.

When you select **OK** to create the device, the *Device Properties* dialog box opens.

Genius General Device Properties



Use the *General* properties to enter general information for the port. You can define the following:

Port Select the port for this device.

- You can click the Browser button - ... - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - > - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource Enter the resource that can be associated with this device for alarm generation.

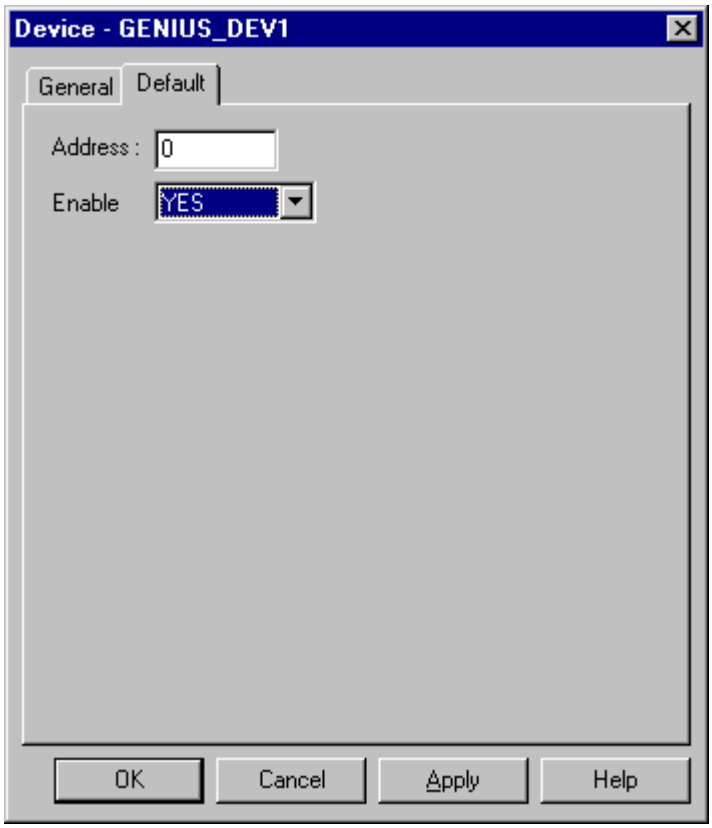
- You can click the Browser button - - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Enter the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol the choices are:

BUS INTERFACE UNIT
GE Fanuc Genius Analog Block
GE Fanuc Genius Digital Block
GE Fanuc Series 90-30
GE Fanuc Series 90-70
GE Fanuc Series Six
GE Fanuc Series Six (no diag)
Generic Global

Analog Blocks are 4 input/2 output Genius Analog Blocks. Digital Blocks include 8, 16, and 32 channel digital blocks.

Genius Default Device Properties



Use the Default tab in the Device dialog box to enter the following information about the device:

Address	Enter the Serial Bus Address (SBA) of the device that you are communicating with in this field.
Enable	Enter **YES** to enable the device. If you enter **NO**, the device will not be enabled, and points associated with the device will be unavailable.

Genius Device Point Configuration

When you define a point, the following fields have values that are unique to or have special meanings for Genius Communications.

Genius General Point Properties

On the General tab in the Point Properties dialog box, you may configure points for **Read** or **Read/Write** access.

Genius Device Point Properties

On the Device tab in the Point Properties dialog box:

Address

For all programmable controller memory types, enter the memory type and offset in the **Address** field on the *Device* page of the *Point Properties* dialog box. The address format is:

<memory type><address>

For example, to specify Register 1, the address is **%R1**. All offsets have a minimum value of 1.

Update Criteria

The update criteria determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by Genius communications at regular intervals.

Select **Unsolicited** for points that will receive unsolicited data from devices using Genius communications.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by Genius communications at regular intervals while users are viewing them.

When you are configuring Boolean points for memory types that are not bit addressable, you must also enter data in the following field:

Address Offset

Enter the bit offset that corresponds to the bit position within the word.

An address offset of 0 addresses the least significant bit of a register. An address offset of 15 addresses the most significant bit.

If you are configuring output points for Genius blocks, don't forget to implement a method for enabling outputs to the blocks.

To write to the outputs of an analog block, use **%DO1** (Directed Output) for the first output circuit and **%DO2** for the second output circuit. Prior to writing data to the block, you must enable outputs to it.

Enabling Directed Outputs to Analog Blocks

Before you can set directed outputs (**%DO**) on an Analog Block or receive unsolicited fault reports, you must enable outputs to that block. To enable outputs to a block, configure a digital point on that block with the address **%EO1**. When the CIMPLICITY HMI project starts, the point at **%EO1** will be set to FALSE (0) and outputs to the block are disabled. When you set **%EO1** to TRUE (1), outputs are enabled to the block and can be used to control the block's outputs.

You can use any of the following CIMPLICITY HMI functions to set **%EO1**:

- A Setpoint action on a **CimView** screen.
- A script that performs a setpoint in the Basic Control Engine.
- A Point Management API procedure that performs a setpoint.

Once the **%EO1** point is set to TRUE, directed outputs may be set.

Enabling Outputs to BIUs

Before you can set outputs (**%Q** and **%AQ**) on a BIU, you must enable outputs to it. To enable outputs to a BIU, configure a digital point on the BIU with the address **%EO**. When the CIMPLICITY HMI project starts, the point at **%EO** will be set to FALSE (0) and outputs to the BIU are disabled. When you set **%EO** to TRUE (1), outputs are enabled to the BIU and can be used to control the block's outputs.

You can use any of the following CIMPLICITY HMI functions to set **%EO**:

- A Setpoint action on a **CimView** screen.
- A script that performs a setpoint in the Basic Control Engine.
- A Point Management API procedure that performs a setpoint.

Once the **%EO** point is set to TRUE, outputs to the BIU may be set.

Configuring Global Data Points on Programmable Controllers

To read Global Data that is broadcast from a programmable controller, use the memory type **%GL**. The address is in bytes and ranges from 0 to 127. For example, if you have configured a Series 90-70 programmable controller to broadcast 64 registers of global data starting at register 100, then to read the data that is in register 100, configure an analog point with the address **%GL0**. Because each register uses two bytes of data, data from register 101 is at address **%GL2**, and data from register 110 is at address **%GL20**.

Note

Global data can only be read from programmable controller memory. You cannot use global memory to write to programmable controller memory.

Configuring Global Data from Digital Blocks

For all digital blocks, use **%GL** to read the global data or to write data to the block. The first circuit on a digital block is addressed as **%GL1**. Prior to writing data to the block, you must enable outputs to it.

Configuring Global Data from Analog Blocks

For 4 input/2 output analog blocks, use **%GL** to read the global data from the block. The first circuit on an analog block is addressed as **%GL1**; the second is **%GL2**, and so on.

Genius Fault Data

You can collect fault data from the following Genius blocks:

- 115 VAC 4 In/2 Out Analog Block - Phase B (IC660BBA100)
- /48 VDC 16 Circuit Sink I/O Block - Phase B (IC660BBD020)

Configuring Fault Points for IC660BBD020 Blocks

For the 24/48 VDC 16 Circuit Sink I/O Block - Phase B (IC660BBD020), configure points **%GD0** through **%GD16**, where **%GD0** is the Block-Level diagnostic point, and **%GD1** through **%GD16** are the Circuit-Level diagnostic points.

Note

If you do not configure **%GD0**, no fault data is collected. If you do configure **%GD0**, but do not configure points between **%GD1** and **%GD16**, messages for the missing points are generated in the Status Log at startup and whenever a fault occurs.

All diagnostic points are **Analog** device points with a Point Type of **USINT**. The **Update Criteria** is **On Change** for the Block-Level diagnostic point, and **Unsolicited** for the Circuit diagnostic points.

Prior to receiving fault data from the block, you must enable outputs to it.

Configuring Fault Points for IC660BBA100 Blocks

For the 115 VAC 4 In/2 Out Analog Block - Phase B (IC660BBA100), configure points **%GD0** through **%GD6**, where:

- **%GD0** is the Block-Level diagnostic point.
- **%GD1** through **%GD4** are the Circuit-Level diagnostic points for inputs.
- **%GD5** through **%GD6** are the Circuit-Level diagnostic points for outputs.

Note

If you do not configure **%GD0**, no fault data is collected. If you do configure **%GD0**, but do not configure points between **%GD1** and **%GD6**, messages for the missing points are generated in the Status Log at startup and whenever a fault occurs.

All diagnostic points are **Analog** device points with a Point Type of **USINT**. The **Update Criteria** is **On Change** for the Block-Level diagnostic point and **Unsolicited** for the Circuit-Level diagnostic points.

Prior to receiving fault data from the block, you must enable outputs to it.

Decoding Fault Data

You can use the information contained in the Block-Level and Circuit-Level diagnostic points on 24/48 VDC 16 Circuit Sink I/O Block - Phase B (IC660BBD020) and 115 VAC 4 In/2 Out Analog Block - Phase B (IC660BBA100) blocks to display detailed information or generate alarms when faults occur.

Decoding IC660BBD020 Block Fault Data

Use the following table to decode the reported values for the Block-Level diagnostic points for 24/48 VDC 16 Circuit Sink I/O Block - Phase B Blocks:

Bit	Diagnostic Fault
0-2, 4-7	*Not used*
3	Terminal Assembly EEPROM fault

Use the following table to decode the reported values for Circuit-Level diagnostic points for 24/48 VDC 16 Circuit Sink I/O Block - Phase B Blocks:

Bit	Diagnostic Fault
0	Loss if I/O power
1	Short circuit
2	Overload
3	No load, or input open wire
4	Over temperature
5	Failed Switch
6	*Not used*
7	*Not used*

Decoding IC660BBA100 Block Fault Data

Use the following table to decode the reported values for the Block-Level diagnostic points for 115 VAC 4 In/2 Out Analog Block - Phase B Blocks:

Bit	Diagnostic Fault
0, 1, 2, 4	*Not used*
3	Terminal Assembly EEPROM fault
5	Electronics Assembly EEPROM fault
7	Internal circuit fault

Use the following table to decode the reported values for Circuit-Level diagnostic points for 115 VAC 4 In/2 Out Analog Block - Phase B Blocks:

Bit	Diagnostic Fault
0	Input low alarm
1	Input high alarm
2	Input under range
3	Input over range
4	Input open wire
5	Output under range
6	Output over range
7	Feedback error

PCIM Port Global Data Broadcast

You can configure a PCIM card to broadcast up to 128 bytes of global data.

Port Configuration

PCIM cards can be setup to broadcast up to 128 bytes of global data. The CIMPLICITY HMI Genius communications interface now supports the ability to configure PCIM cards used for communication in CIMPLICITY HMI so that they can broadcast data. For any PCIM card to broadcast global data, it is necessary to go to the port selection of the project and reconfigure the Port of interest.

The **Reference address** is used by some Genius devices to specify the logical address that may correspond to where the device's I/O data is stored in host memory.

- For many devices such as the Series 90, this information is not used.
- For other devices, such as a Series Five or Series Six, you will need to enter a value.

See the Bus Controller (or Device) *User's Manual* for *each* device on your Genius network to determine what the configuration requirements are. You may only configure one reference address for each port of a PCIM card and this must be compatible with all devices on the Genius network. The value entered must fit within 16 bits. The high bit is always ON, regardless of the value entered for the reference address.

The **Broadcast length** specifies the number of bytes a port on a PCIM card will broadcast. A value of zero, the default value, specifies NO BROADCAST data. A value between 1 and 128 defines the number of bytes of data to be broadcast as well as the size of the directed control input table on the port of the PCIM card.

Device Configuration

To configure your PCIM card to broadcast data, create a device that corresponds to your PCIM card. To do this:

- Select **GENERIC GLOBAL** for the **Model Type**.
- Enter the Serial Bus Address (SBA) of the PCIM port in the **CPU ID**.

Memory Addressing

Broadcast Global data is referenced by using the **%GL** memory type. The offset entered corresponds to the byte offset of the PCIM card. **%GL0** is the first offset and refers to BYTE 1, **%GL1** is BYTE 2, etc.

Broadcast data may be modified by performing setpoint operations on the points configured for the device. You must ensure that the number of byte being broadcast is compatible with other devices on the network. For example, if the broadcast data is being mapped to the Register memory of a Series 90 Bus Controller, the number of bytes broadcast needs to be on an even-byte boundary.

Special Cautions

You need to know that:

- Each time the Genius Communication enabler starts, the data broadcast by the PCIM card is initialized to zero. Previous values are not maintained.
- For applications where PCIM cards are broadcasting data and Series 90 processors are present on the bus, you must map the System Configuration Mismatch to a Diagnostic Category rather than the default classification of FATAL on each Series 90 processor.

  If you do not modify this classification, the Series 90 will go to a FAULT/STOP category each time the PCIM is initiated.

Monitoring Broadcast Data from Generic Devices

To monitor data broadcast from devices not otherwise configurable from a CIMPLICITY HMI project, configure a device on the PCIM port with:

- Model type of **GENERIC GLOBAL**
- CPU ID corresponding to the Serial Bus Address (SBA) of the device.

To access the broadcast data, use the **%GL** memory type with an offset between 0 and the broadcast length of the device. Broadcast data is byte addressable. **%GL0** is used to reference the first byte of the data, **%GL1** the second byte, etc.

Broadcast data from devices other than your own PCIM port may not be modified via CIMPLICITY HMI software.

Broadcast data for a device is assumed to have a static length. If the broadcast data length changes, you need to disable and re-enable the device so that the change will be properly processed by the Genius Communications enabler.

Receiving Unsolicited Datagrams

To send data from a Series 90 or Series Six processor to a PCIM port, use the WRITE DEVICE (subfunction code 20) to direct the data to the PCIM card. The format of the message is the same as that defined for sending data to a Series 90 Bus Controller.

To define CIMPLICITY points to receive the unsolicited data, follow these directions:

- For points on a Series Six processor, use Series Six style addresses for memory addressing:

  R<offset> for registers
  I<offset> for Inputs
  O<offset> for outputs
  Note that the first letter must be capitalized.

- For points on a Series 90 processor, use Series 90 style addresses for memory addressing. The format of the address is **%<MEMORY_TYPE><OFFSET>**. Note that the **MEMORY_TYPE** must be capitalized.

Honeywell IPC 620 Communications

Introduction

The Honeywell IPC 620 Protocol Device Communication driver lets you exchange data between CIMPLICITY HMI software and Honeywell's IPC 620 family PLCs using the Asynchronous Byte Count (ABC) protocol.

Supported Devices

The Honeywell ABC Protocol device communication option supports the following Data Collection Modules:

- 620-0048 DCM Module (revision VR 3.1 or later)
- 620-0042 DCM Module (prom revision 21024L or later)

and the following PLCs:

- IPC 620-12
- IPC 620-15
- IPC 620-16
- IPC 620-20
- IPC 620-30

Up to 32 programmable controllers may be connected to CIMPLICITY HMI over on a single serial connection.

If your DCM module is at an earlier revision than listed above, you may encounter interoperability issues. For additional information on this subject and upgrades, please contact your Honeywell representative.

Additional Documentation

You should have the following documentation, as it applies to your hardware configuration, available when configuring this interface:

- 620-0048 & 620-0052 Data Collection Modules User Manual, 620-8980
- IPC 620 Communications Interface Module User Manual, Model IPC 620-0042
- 620 Logic Controller Modular Automation System
- IPC 620 Programmable Controller Module IPC 620-10 and 620-15, 620-8999
- IPC 620 Programmable Controller Module IPC 620-20, 620-8998
- IPC 620 Programmable Controller Module IPC 620-30

Supported Memory Types

Memory Types	Access
Digital	Read/Write
Register *	Read/Write
Extended Register *	Read/Write
System Status Register	Read

* On 620-15, 620-20 and 620-30 programmable controllers, register data is represented in 17 bits. When accessing these registers, using the register memory type, values between 0 and 32767 will display consistently between CIMPLICITY HMI and the programming software. For the aforementioned processors, for values outside of this range, the extended register memory type should be used. When the extended memory type is used, 17 bit values are converted to 32 bits. This 32 bit representation can be mapped to a standard CIMPLICITY HMI point type. (Analog_32 signed, for example). For 620 programmable controllers which represent the register data using 16 bit registers.

When floating point data values are configured, they must be mapped over the register type only. Extended register will not support floating point data. One floating point value consumes two 16-bit registers of storage, so arrays of floating point values consume twice as many registers as they contain elements.

Hardware Configuration Requirements

The Honeywell ABC Protocol allows up to 32 programmable controllers to be connected to CIMPLICITY HMI system over on a single serial connection.

If using an RS232 serial port and connecting to a DCM configured for RS485 operation, an RS232 to RS485 converter box will be required. When conversion is required, the use of an isolated converter box is recommended.

Custom Cable

The following connections are required in the cable that connects DCM and CIMPLICITY HMI system:

There are two types of configurations for interconnecting DCM(s) to a host:

- Point-to-point connection is between only one DCM and the host
- A multipoint/multidrop configuration connects two or more DCMs to the host on a common line. This is a single master and series of slaves.

CIMPLICITY System Configuration

In your NT system's Control Panel, select *Ports*. The various ports that can be used for device communications will be listed. The serial communication ports are listed as COM1, COM2, etc. Select one port for each physical device communication process required. Hardware Installation External to the Computer

Hardware Checklist

1. Honeywell IPC 620 family PLC and Data Collection Module as described in section ***Supported Devices.***
2. Verify that green indicators in PLC and DCM are on for power and self-test.
3. Custom Cable wired as shown in the diagram in ***Custom Cable***.
4. RS-232 Port on NT Host Computer.
5. Connect DCM and CIMPLICITY HMI system using the custom cable.
6. Use **`hwabc_diag`** program to verify communication.

Installation Verification Procedures

Honeywell ABC Diagnostics

The Honeywell ABC Diagnostics program, **hwabc_diag.exe**, may be used to verify hardware installation and communication operation.

To run the N2 diagnostics, execute the following command:

hwabc_diag.exe <*port***> <***network drop #***> <***Baud* **> <***Parity***>**

Where

<*port*> is the name of the port connected to the connection cable.

<*network drop #*> is the network nodal address of DCM which can be from 0 to 31. The default value is 0.

<*Baud Rate*> has a default value of 9600.

<*Parity*> is none by default.

For example, if your connection cable is attached to COM2, network drop number is 2 for the DCM, baud rate is 9600 and parity is none, execute the following command:

```
hwabc_diag.exe COM2 2
```

The Honeywell ABC Diagnostics program will open the port and read values of a few points:

```
Comm parameters: drop 2, baud = 9600, parity = no
```

CIMPLICITY Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to Honeywell ABC Device Communications.

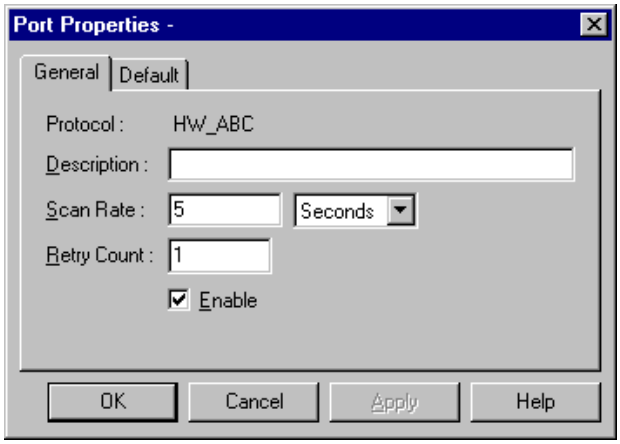
Honeywell ABC Device Communications Port Configuration

When you create a new port for Honeywell ABC Device Communications, enter the following information in the *New Port* dialog box:

1. In the Protocol field, select HW_ABC from the list of available protocols
2. In the Port field, select that communication port that will be used for Honeywell ABC Device communications.

When you select **OK** to create the port, the Port Properties dialog box for the protocol opens.

Honeywell IPC 620 General Port Properties

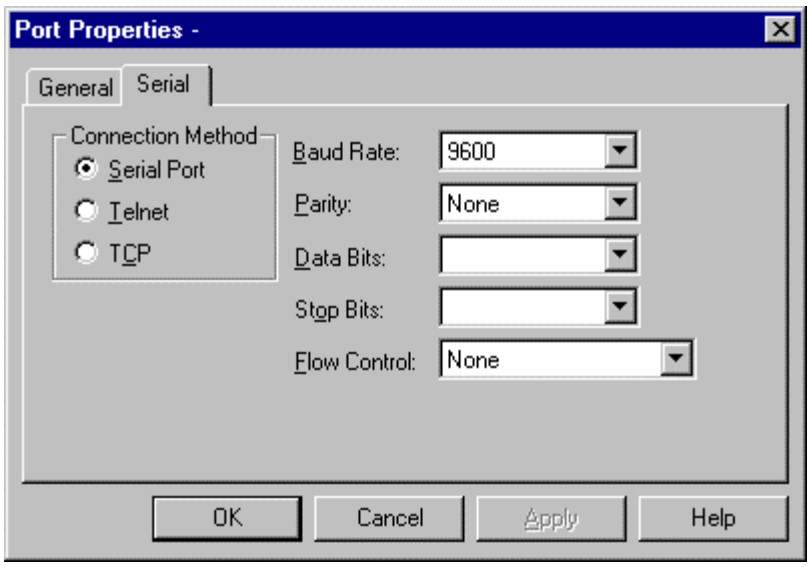


Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rates. You can specify a scan rate in Ticks (100 ticks = 1 second), Seconds, Minutes, or Hours.
Retry Count	If communications cannot be established to a device on this port, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connection to it. Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.
Enable	Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Honeywell IPC 620 Serial Port Properties

Use the Default tab in the Port Properties dialog box to enter communication information for the port.



If you select the serial port connection method, you need to define the following:

Baud Rate	Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.
Data Bits	Select the number of data bits per word to be used for communications.
Parity	Select the parity to be used for communications.
Stop Bits	Select the number of stop bits to be used for communications
Flow Control	Select the type of flow control to be used for communications. If you change the Flow Control type, you must reboot the PC for the changes to take affect.

Remember that you must configure the same baud rate, data bits, parity, stop bits and flow control for all PLCs using the serial port.

Honeywell ABC Device Communications Device Configuration

You must configure one device for each Honeywell device from which you will collect data using Honeywell ABC Device communications.

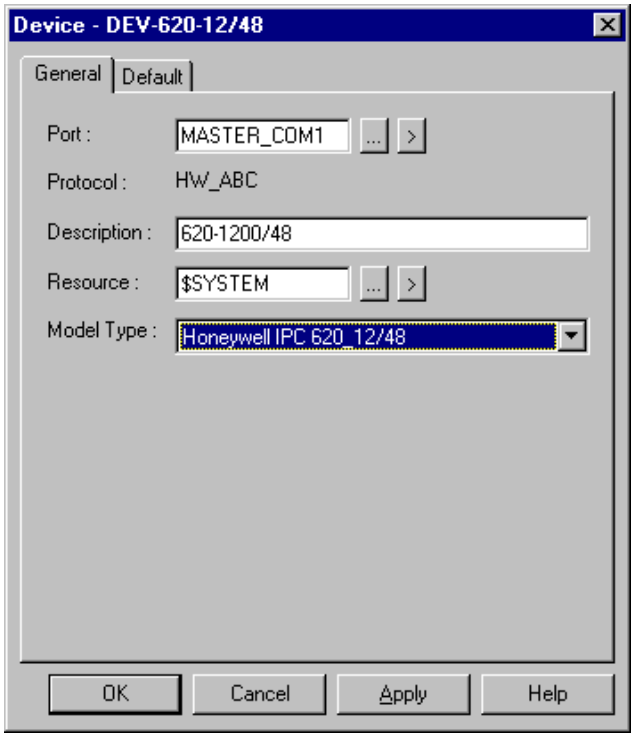
When you create a new device for Honeywell ABC Device communications, enter the following information in the *New Device* dialog box:

1. In the Device field, enter the name of the device you are configuring.
2. In the Port field, select the Honeywell ABC Device communications port to be used by the device.

When you select **OK** to create the device, the Device Properties dialog box opens.

Honeywell IPC 620 General Device Properties

Use the General tab in the Device dialog box to enter general information for the device.



You can define the following:

Port — Select the port for this device.

You can click the **Browse** button ... to the right of the field to display the list of ports and select one.

You can click the **Popup** button > to create a new port, edit the current port, or select a port from the list of ports.

Description — Enter an optional description to help you identify the device.

Resource — Enter a resource that can be associated with this device for alarm generation.

You can click the **Browse** button ... to the right of the field to display the list of resources and select one.

You can click the Pop-up Menu button > to create a new resource, edit the current resource, or select a resource from the list of resources.

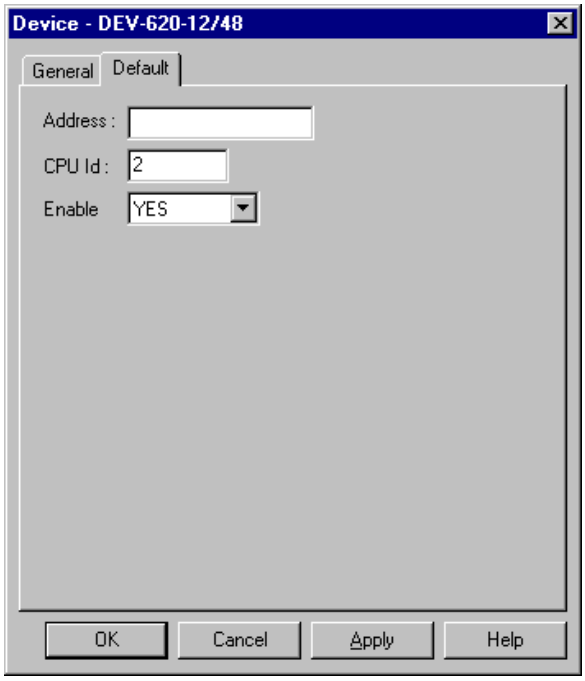
Model Type — Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the choices are:

Honeywell IPC 620_12/48
Honeywell IPC 620_15/48
Honeywell IPC 620_16/48
Honeywell IPC 620_20/48

Honeywell IPC 620_30/48
Honeywell IPC 620_12/52
Honeywell IPC 620_15/52
Honeywell IPC 620_16/52
Honeywell IPC 620_20/52
Honeywell IPC 620_30/52

Honeywell IPC 620 Default Device Properties

Use the Default tab in the Device dialog box to enter information about communications for the device.



You can define the following:

Address	Enter the network node number here when the type of configuration for interconnecting DCMs to the host is multipoint/multidrop. This number is set up by DIP switch on the actual device. The node numbers may run from zero through 31.
CPU Id	Not used.
Enable	Set this check box to enable the device when the project starts. If you clear this check box blank, the device will not be enabled and points associated with the device will be unavailable.

Honeywell ABC Device Communications Point Configuration

Once your devices are configured, you may configure points for them. The fields described below have configuration values that are unique to or have special meaning for Honeywell ABC device communications..

General Point Memory Types

On the General tab in the Point Properties dialog box, select Read/Write for all the memory types except *System Status Register*.

Honeywell IPC 620 Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria The update criteria field determines how the data will be requested.

Select On Change or On Scan for points whose values should be polled by the Honeywell driver at regular intervals.

Address A Honeywell device point address consists of a one or two character alphabetic field, followed by an n-digit decimal-numeric field. The numeric field reflects the offset within an addressing domain, of the particular point. The alphabetic fields map to domains according to the following table:

Enter the point address as follows:

Type of Memory	Address Format	Numeric Range
Digital	D*n*	0 – system-specific (up to 4095)
		4096 – system-specific (17 bit models)
Register *	R*n*	4096 – system-specific
Extended Register *	ER*n*	4096 – system-specific
System Status Register	S*n*	2048 – 4095

Note: Points may be configured to use any CIMPLICITY point type, however, it is advisable to maintain consistency between the CIMPLICITY point type and the data representations supported by the underlying programmable controller. For example, only 620-12 and 620-16 processors support floating point numbers. When using other processor types, it is recommended that you do not configure REAL CIMPLICITY point type.

Warning: Extreme care should be taken when referencing Intelligent Module I/O. Honeywell indicates that references to invalid Intelligent Module I/O may cause interoperability issues with programmable control operation.

Johnson Controls N2 Bus Communications

About Johnson Controls N2 Bus Communications

The Johnson Controls N2 Bus Communications option lets you exchange data between CIMPLICITY HMI software and Johnson Controls devices.

The Johnson Controls N2 Bus Communication option supports Read and Write values. This communication option does not support array points.

Supported Devices

The N2 System Protocol device communication option supports Johnson Controls N2 Open and DX9100 protocols. Supported device types are:

- Unitary Controllers (UNT)
- DX9100 Digital Controller (DX9100)

While not explicitly supported, other Johnson Controls and third-party devices may work to the extent that they implement the available protocols.

Additional Documentation

The Johnson Controls document ***Metasys DX9100 Protocol Specification*** lists all the data items available in the DX9100.

Supported Memory Types

The Johnson Controls N2 Bus Communications option supports Unitary Controller and DX9100 memory types.

Unitary Controller Memory Types

Data may be read from the following regions in the Unitary Controller:

- Analog Inputs
- Analog Outputs
- Binary Inputs
- Binary Outputs
- Internal Floating-Point data
- Internal Integer data
- Internal Byte data
- Device Memory

Data may be written to the following regions in the Unitary Controller:

- Analog Inputs
- Analog Outputs
- Binary Outputs
- Internal Floating Point data
- Internal Integer data
- Internal Byte data

DX9100 Memory Types

The DX9100 supports reading from all the memory types supported by the Unitary Controller, except Device Memory. In addition, the following memory types may be read:

- Logic Results
- Programmable Module Constants
- Programmable Module Outputs
- Programmable Module Logic
- Programmable Module Accumulator

The DX9100 supports writing to all the memory types supported by the Unitary Controller except Analog Inputs. In addition, the following memory types may be written:

- Logic Results
- Programmable Module Constants
- Programmable Module Outputs
- Programmable Module Logic
- Programmable Module Accumulator

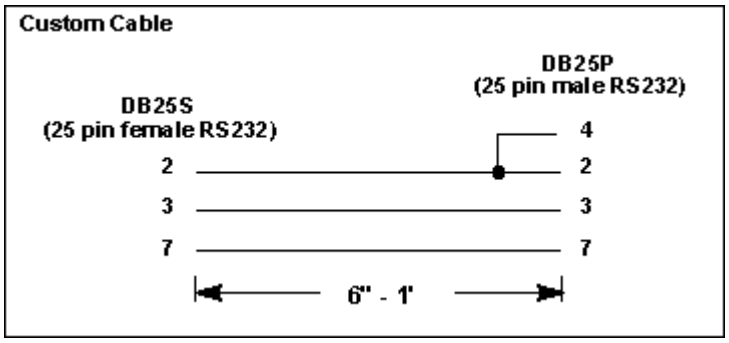
Hardware Configuration Requirements

The N2 Protocol allows one master and up to 255 slaves on a common line. In the CIMPLICITY HMI computer, the Johnson Controls N2 Bus Device Communications Enabler is the master.

The N2 bus is RS-485 based but uses special biasing to allow 50 nodes without a repeater. The Johnson Controls MM-CVT101-0 converter is required for adapting the CIMPLICITY HMI computer's RS-232 serial port to the N2 bus.

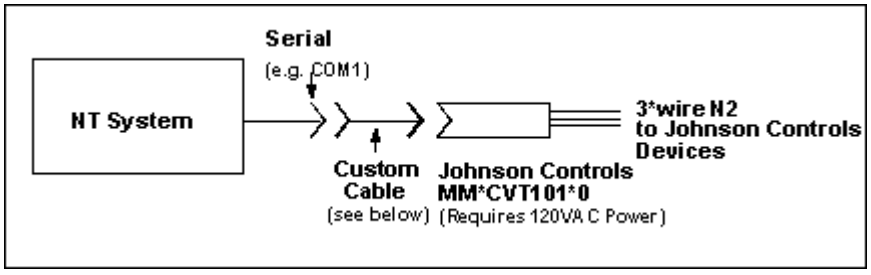
Custom Cable

The following connections are required in the custom cable.



N2 Bus Cabling

The N2 bus cabling looks like this.



Hardware Installation External to the Computer

You need to do the following before using the Johnson Controls N2 Bus Controller Communications option:

1. Acquire MM-CVT101-0 from Johnson Control.
2. Acquire or fabricate Custom Cable as shown in Figure 1-1.
3. Select RS-232 Port on NT Host Computer.
4. Assemble as shown in Figure 1-2.
5. Verify that green power indicator in MM-CVT101-0 is on.
6. Use **n2_diag** probe command to verify communication.

Installation Verification Procedures

You can use the N2 Diagnostics program, **n2_diag.exe**, to verify hardware installation and network operation.

To run the N2 diagnostics, execute the following command:

```
n2_diag.exe <port>
```

where **<port>** is the name of the port connected to the N2 bus.

For example, if your N2 bus is attached to **COM2**, execute:

```
n2_diag.exe COM2
```

The N2 Diagnostics menu displays:

```
====================
N2 Diagnostics menu
--------------------
1) Probe N2 network
2) Select a device
3) Parse an address
4) Dump XT config.
5) Read a value
6) Write a value
7) Turn on tracing
8) Turn off tracing
9) Dump statistics
0) Quit diagnostics
```

Use the numbers at the left to select options. You are prompted for other parameters as needed. The options are briefly described in the following sections.

Probe N2 Network

When you select **Probe N2 network**, you are prompted for a starting and ending address. The diagnostic program scans from the starting address to the ending address trying to identify devices. For each address where a device is found, the device type ID is reported in hexadecimal (base 16). For each address where no device is found, two question marks are printed.

In this example, the starting address is 1 and ending address is 8. The only devices configured are a DX9100 at N2 bus address 1 and a UNT at N2 bus address 7.

```
First address to probe [1]:1
Last address to probe [255]:8
.15.??.??.??.??.??.71.??
```

Select a Device

Many of the diagnostic functions are dependent on the type of the device you select. For these operations, you must select a device to work with. When you choose **Select a device**, you can change devices.

```
Device [0]:7

====================
N2 diagnostics menu
--------------------
Type 0x71 device at address 7 selected
```

Parse an Address

Use **Parse an address** to test address strings for validity on the currently selected device.

For example, for a unitary controller, AI[300] is invalid because there are only 256 records in each region.

```
Address<region[record].attr>:AI[2]
Valid
   domain_index = 1, domain_offset = 54

Address<region[record].attr>:AI[300]
Invalid
```

Dump XT Configuration

A DX9100 may have one or more extension (XT) modules installed. Use the **Dump XT configuration** option to query the currently selected device for its XT configuration and report it to the screen.

In the report:

- **X** corresponds to an installed input/output point.
- **-** corresponds to an input/output point which is not installed.

For example, there are two XT modules.

- The first module has 8 analog points: 6 inputs and 2 outputs. For this module, AI[9] through AI[14] are valid input addresses and AI[15] through AI[16] are valid output addresses.
- The second module has 8 binary points: four inputs and four outputs. For this module, BI[17] through BO[20] are valid input addresses, and BO[21] through BO[24] are valid output addresses.

The report to the screen looks like this:

```
XT 1            Analog                          Binary
          09 10 11 12 13 14 15 16     09 10 11 12 13 14 15 16
  In      X  X  X  X  X  X  -  -      -  -  -  -  -  -  -  -
  Out     -  -  -  -  -  -  X  X      -  -  -  -  -  -  -  -
XT 2            Analog                          Binary
          17 18 19 20 21 22 23 24     17 18 19 20 21 22 23 24
  In      -  -  -  -  -  -  -  -      X  X  X  X  -  -  -  -
  Out     -  -  -  -  -  -  -  -      -  -  -  -  X  X  X  X
```

Read a Value

Read a value prompts for an address string, and then attempts to read a value from that address in the currently selected device. Values are reported in floating point, decimal, and hexadecimal format. You must know what type of data to expect to properly interpret the read results.

For example, reading an Analog Input might return:

```
Read 4 bytes, Value is 260.000000 1132593152
(0x43820000)
```

Because this is a floating-point value, only the first value (260.0) is meaningful.

Reading an integer value such as an Internal Integer (ADI) might return:

```
Read 2 bytes, Value is 0.000000 12346 (0x0000303a)
```

In this case, because the ADI is an integer value, the 0.0 is meaningless and the correct value is the decimal integer 12346.

Write a Value

`Write a value` prompts for an address string, data type, and value, then attempts to write the value to the specified address in the currently selected device. You must know the data type for the point for the write to succeed.

For example, to write a value to Analog Output 1:

```
Address(region[record].attr): ao[1]
Data type?
1) Bit
2) Byte
3) Integer
4) Long
5) Float
5
Value:3.141593
```

Because Analog Outputs are floating point numbers, data type 5 (float) was picked from the Data Type list in the above example.

NT System Configuration

You must specify the number of N2 System Protocol interfaces to be configured for your CIMPLICITY system. In your NT system's Control Panel, select *Ports*. The various ports that can be used for device communications will be listed. The serial communication ports are listed as COM1, COM2, etc. Select one port for each physical device communication process required.

CIMPLICITY Application Configuration

When configuring ports, devices, and points that use the Johnson Controls N2 Bus Communications enabler, some fields must contain unique values for the communications to work successfully. These are detailed below.

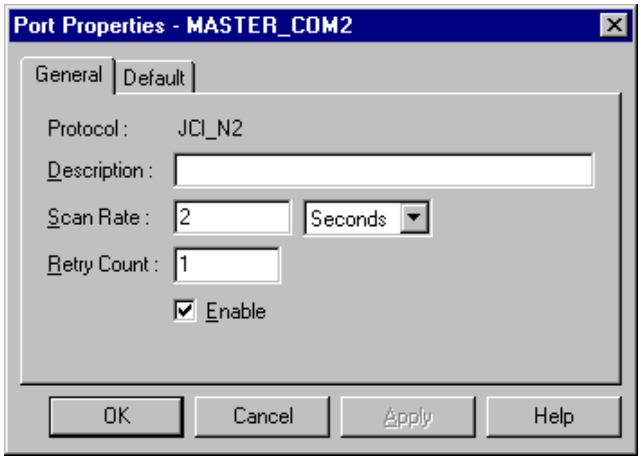
Port Configuration

When you configure a port for Johnson Controls N2 Bus Communications, enter the following in the *New Port* dialog box:

1. In the **Protocol** field, select **JCI_N2** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for Johnson Controls N2 Bus Controls Communications.

When you select **OK**, the *Port Properties* dialog box for the protocol opens.

General Port Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description Enter an optional description to help you identify the port.

Scan Rate Enter the base scan rate for the port. Point scan rates are multiples of the base rate.

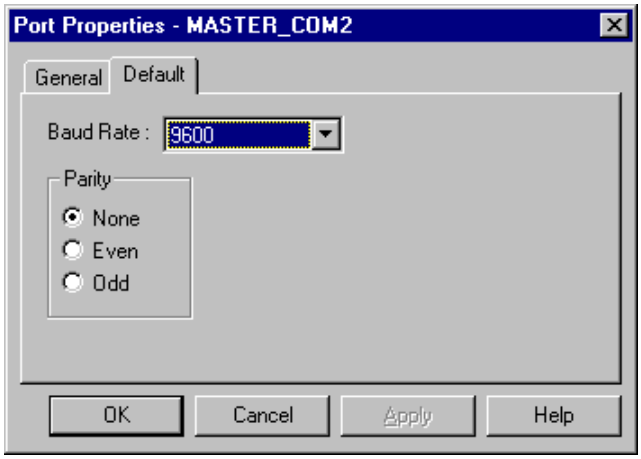
You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Default Port Properties



Use the *Default* properties to enter information about the Johnson Controls N2 Bus Communications for the port. You can define the following:

Baud Rate Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.

For Johnson Controls N2 Bus Communications, select **9600**.

Parity Select the parity for communications.

For Johnson Controls N2 Bus Communications, select **None**.

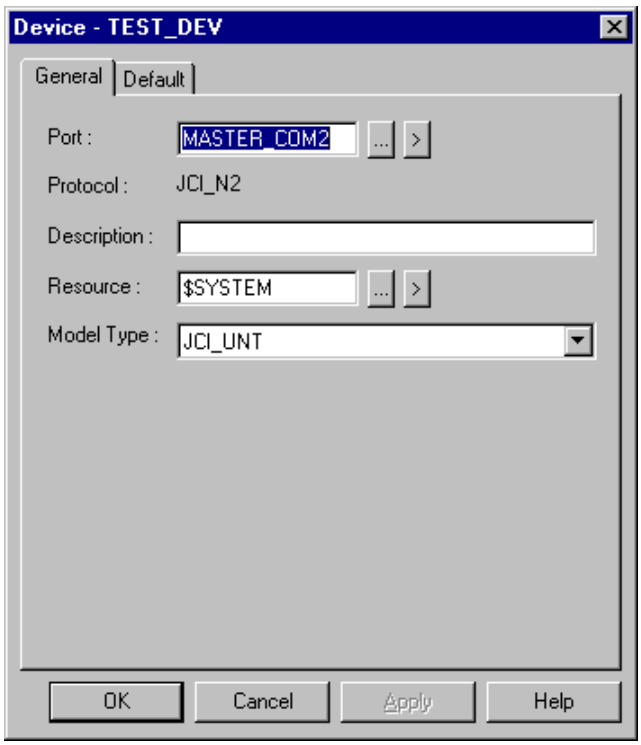
Device Configuration

When you configure a device for Johnson Controls N2 Bus Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Johnson Controls N2 Bus Communications port to be used for the device.

When you select **OK**, the *Device Properties* dialog box for devices using this protocol opens.

General Device Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port — Select the port for this device.

- You can click the Browser button - ... - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - > - to create a new port, edit the current port, or select a port from the list of ports.

Description — Enter an optional description to help you identify the device.

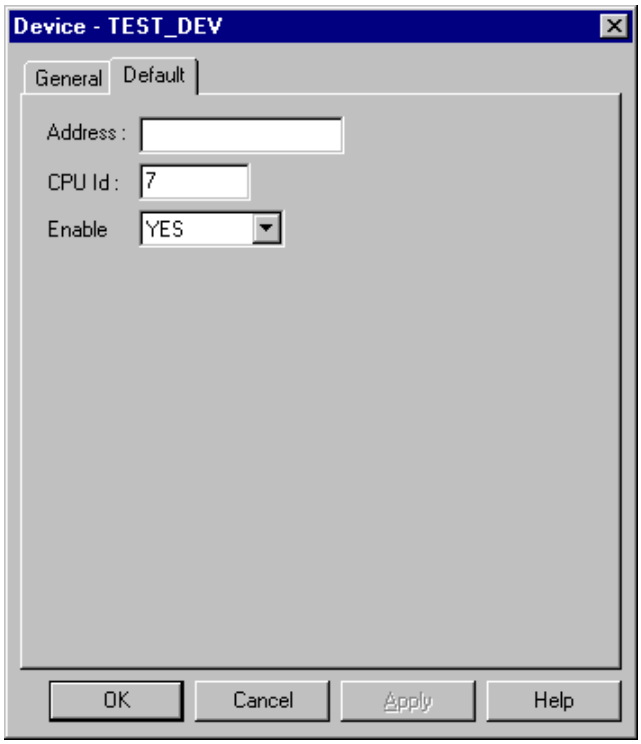
Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button - - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, and make a selection. For this protocol, the choices are:

JCI_DX9100R1	Device is DX9100 Revision 1
JCI_DX9100R2	Device is DX9100 Revision 2
JCI_N2_BASE	Device supports N2 Base protocol
JCI_N2_OPEN	Device supports N2 Open protocol
JCI_UNT	Device is Unitary Controller

Default Device Properties



Use the *Default* properties to enter information about the Johnson Controls N2 Bus Communications for the device. You can define the following:

Address	*Not used.*
CPU ID	Enter the decimal address of the device on the N2 bus.
Enable	Set this check box to enable the device when the project starts. If you clear this check box, the device will not be enabled and points associated with the device will be unavailable.

Point Configuration

When you define a point, the following fields have values that are unique to or have special meanings for Johnson Controls N2 Bus Communications:

General Point Properties

On the *General* property page, you may configure points for **Read** or **Read/Write** access.

Array points are not supported. Set **Elements** to **1**.

Device Point Properties

On the *Device* property page:

Address

Enter the point address of the data as follows:

```
region[record].attribute
```

where:

region specifies the point type from the table.

record is the index within the region.

attribute specifies what information about that record is to be processed.

For example, to access the value of the Analog Input 3, configure a point with the address:

```
AI[3].VALUE
```

If you do not specify an attribute, the current value is assumed. Thus, the previous example is equivalent to:

```
AI[3]
```

For Unitary Controllers, the record range is 1–256. See *Point Types* for the record number ranges in each DX9100 region.

Update Criteria

The update criteria determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by Johnson Controls N2 Bus Communications at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by Johnson Controls N2 Bus Communications at regular intervals while users are viewing them.

When you are configuring Boolean points for memory types that are not bit addressable, you must also enter data in the following field:

Address Offset

Enter the bit offset that corresponds to the bit position within the word.

The valid range for bit offset is 0-15, where 0 is the least significant bit. The bit offset must be specified as a decimal value.

For binary I/O on Unitary Controllers, the bit offset for a point is always 6.

For binary inputs on a DX9100, the bit offset is one less than the remainder from dividing the record number by 8. For example, BI[1] is at bit offset 0 and BO[45] is at bit offset 4 (45 % 8 = 5. 5 – 1 = 4).

For the first 8 binary outputs on a DX9100, consult the table on page A-3. For binary outputs 9 and above, the bit offset is one less than the remainder from dividing the record number by 8.

Point Types

The UNT and DX9100 point types are organized in regions, which correspond to various types of input/output and internal value. The following table summarizes region names and corresponding CIMPLICITY point types.

Long Name	Short Name	Point Type
Analog Input	AI	FLOAT
Analog Output	AO	FLOAT
Binary Input	BI	DIGITAL
Binary Output	BO	DIGITAL
Internal Floating Point data	ADF	FLOAT
Internal Integer data	ADI	ANALOG_16
Internal Byte data	BD	ANALOG_U8
Logic Results	LRS	DIGITAL
Programmable Module Constants	PMK	ANALOG_U16
Programmable Module Outputs	PMO	FLOAT
Programmable Module Logic	PML	DIGITAL
Programmable Module Accumulator	PMA	ANALOG_U32
System Data	SD	Various
Memory	MD	Application dependent

Each region has a number of records. The exact number of records in a region depends on hardware and software configuration of the device.

Each record has a number of attributes such as current value and alarm limits. Within each region, all records have the same attributes.

Memory

UNT device memory may be read by addressing the MD region name. The device memory is treated as a continuous block of bytes from 0 to 65535. The interpretation of any byte is device dependent. No data conversion is done on MD data.

System Data

The System Data region is a pseudo-region maintained within the device communication process that contains information on the device. There is only one record in the SD region; the device information is accessed as attributes of this record.

For the UNT, the SD region provides the following data:

Description	Address	Point Type
Model ID	SD[1].DEVID	ANALOG_U8
Model name	SD[1].MODEL	TEXT[16]
Days in service	SD[1].SERVICE	ANALOG_U32
Device status	SD[1].STS	ANALOG_U32

For the DX9100, the SD region provides the following data:

Description	Address	Point Type
Model ID	SD[1].DEVID	ANALOG_U8
Firmware Revision	SD[1].FWREV	ANALOG_U8
Supervisory Control Word	SD[1].SUP	ANALOG_U16

Releasing DX9100 Output Holds

When a user setpoint request for a DX9100 output point is processed, the device communication process must set the point value *and* a control bit. The control bit causes the output value to be held at the setpoint value and prevents the DX9100 internal programming from changing it. The hold may be manually released by clearing the control bit via a setpoint.

There are three types of control bits.

- A supervisory control bit controls the first 8 binary outputs.
- A control and status bit controls the first 8 analog outputs.
- All other outputs are controlled by a hold control bit.

Supervisory Control Bits

The supervisory control bits are in a one-byte word. Bits 0 to 5 enable supervisory control of binary outputs 3 through 8. (Binary outputs 1 and 2 are reserved and may not be controlled.)

For example, to monitor and control the supervisory status of BO[5]:

- Configure a binary point with address BO[5].HOLD and bit offset 2.
- After CIMPLICITY software sets a value in BO[5], BO[5].HOLD has a value of 1.
- To release control of BO[5] back to the DX9100 programming, set BO[5].HOLD to 0.

Analog Control and Status

Each analog outputs from 1 to 8 has its own control and status byte. The hold bit is bit 1.

For example, to monitor and control the hold status of AO[2]:

- Configure a point with address AO[2].HOLD, bit offset 0.
- After CIMPLICITY software sets a value in AO[2], AO[2].HOLD has a value of 1.
- To release control of AO[2] back to the DX9100 programming, set AO[2].HOLD to 0.

Hold Control

After BO[8] and AO[8], each group of 8 outputs is controlled by a single hold control byte. The HOLD attribute of several different records map to the same byte and control of individual outputs is accomplished via bit offsets.

The bit offset is one less than the remainder from dividing the record number by 8. For example, the hold control bit for BO[21] is at bit offset 4 and the hold control bit for AO[9] is at bit offset 0.

For example, to monitor and control the hold status of BO[23]:

- Configure a point with address BO[23].HOLD, bit offset 6.
- After CIMPLICITY software sets a value in BO[23], BO[23].HOLD has a value of 1.
- To release control of BO[23] back to the DX9100 programming, set BO[23].HOLD to 0

DX9100 I/O Map

The following table shows the valid range of record numbers in each of the DX9100 regions. Depending on the configuration of extension modules installed in the DX9100, not all records may be available in any particular device.

Region	Valid Range	Notes
AI	1–72	Read only
BI	1–72	Read only
AO	1–72	Setpoint sets hold bit.
BO	1–72	Setpoint sets hold bit.
ADF	1–8	
ADI	1–72	
BD	1–32	
LRS	1–64	Read only
PMK	1–240	These values are stored in EEPROM. They are writable but setpoint should be limited in frequency.
PMO	1–96	
PML	1–96	
PMA	1–96	

The following tables show the mapping between the regions and record used in CIMPLICITY point addresses, and the hardware address of points in the DX9100. These mappings are the same as that of the Johnson Controls Metasys Companion product.

Region Analog Input (AI)

The Region Analog Inputs are:

Record	R/W	Item Description
1–8	R	Analog Input #1–8
9–16	R	Analog Input #1–8 – Expander #1
17–24	R	Analog Input #1–8 – Expander #2
25–32	R	Analog Input #1–8 – Expander #3
33–40	R	Analog Input #1–8 – Expander #4
41–48	R	Analog Input #1–8 – Expander #5
49–56	R	Analog Input #1–8 – Expander #6
57–64	R	Analog Input #1–8 – Expander #7
65–72	R	Analog Input #1–8 – Expander #8

Region Binary Input (BI)

The Region Binary Inputs are:

Record	Bit	R/W	Item Description
1–8	0–7	R	Binary (Digital) Input #1–8
9–16	0–7	R	Binary (Digital) Input #1–8 – Expander #1
17–24	0–7	R	Binary (Digital) Input #1–8 – Expander #2
25–32	0–7	R	Binary (Digital) Input #1–8 – Expander #3
33–40	0–7	R	Binary (Digital) Input #1–8 – Expander #4
41–48	0–7	R	Binary (Digital) Input #1–8 – Expander #5
49–56	0–7	R	Binary (Digital) Input #1–8 – Expander #6
57–64	0–7	R	Binary (Digital) Input #1–8 – Expander #7
65–72	0–7	R	Binary (Digital) Input #1–8 – Expander #8

Region Analog Output (AO)

Setting AO valves sets an output hold that must be manually reset to allow algorithm control of the point. See *Releasing DX9100 Output Holds* for details.

Record	R/W	Item Description
1	W	Analog Output #1
2	W	Analog Output #2
3	W	Analog Output #9
4	W	Analog Output #10
5	W	Analog Output #11
6	W	Analog Output #12
7	W	Analog Output #13
8	W	Analog Output #14
9–16	W	Analog Output #1–8 – Expander #1
17–24	W	Analog Output #1–8 – Expander #2
25–32	W	Analog Output #1–8 – Expander #3
33–40	W	Analog Output #1–8 – Expander #4
41–48	W	Analog Output #1–8 – Expander #5
49–56	W	Analog Output #1–8 – Expander #6
57–64	W	Analog Output #1–8 – Expander #7
65–72	W	Analog Output #1–8 – Expander #8

Region Binary Output (BO)

Setting BO valves sets an output hold that must be manually reset to allow algorithm control of the point. See *Releasing DX9100 Output Holds* for details.

Record	Bit	R/W	Item Description
1	6	W	Shut Off Mode
2	7	W	Start Up Mode
3	0	W	Binary (Digital) Output #3
4	1	W	Binary (Digital) Output #4
5	2	W	Binary (Digital) Output #5
6	3	W	Binary (Digital) Output #6
7	4	W	Binary (Digital) Output #7
8	5	W	Binary (Digital) Output #8
9–16	0–7	W	Binary (Digital) Output #1–8 – Expander #1
17–24	0–7	W	Binary (Digital) Output #1–8 – Expander #2
25–32	0–7	W	Binary (Digital) Output #1–8 – Expander #3
33–40	0–7	W	Binary (Digital) Output #1–8 – Expander #4
41–48	0–7	W	Binary (Digital) Output #1–8 – Expander #5
49–56	0–7	W	Binary (Digital) Output #1–8 – Expander #6
57–64	0–7	W	Binary (Digital) Output #1–8 – Expander #7
65–72	0–7	W	Binary (Digital) Output #1–8 – Expander #8

Region Internal Floating Point Data (ADF)

The Region Internal Floating-Point Data is:

Record	R/W	Item Description
1–8	W	Analog Constant #1–8

Region Internal Integer Data (ADI)

The Region Internal Integer Data are:

Record	R/W	Item Description
1–8	W	DI1–DI8 Pulse Count
9–16	W	DI1–DI8 Pulse Count – Expander #1
17–24	W	DI1–DI8 Pulse Count – Expander #2
25–32	W	DI1–DI8 Pulse Count – Expander #3
33–40	W	DI1–DI8 Pulse Count – Expander #4
41–48	W	DI1–DI8 Pulse Count – Expander #5
49–56	W	DI1–DI8 Pulse Count – Expander #6
57–64	W	DI1–DI8 Pulse Count – Expander #7
65–72	W	DI1–DI8 Pulse Count – Expander #8

Region Internal Byte Data (BD)

The Region Internal Byte Data are:

Record	Bit	R/W	Item Description
1–16	0–15	W	Logic Constant #1–16
17–32	0–15	W	Logic Constant #17–32

Region Logic Results (LRS)

The Region Logic Results are:

Record	Bit	R/W	Item Description
1–16	0–15	R	Logic Result #1–16
17–32	0–15	R	Logic Result #17–32
33–48	0–15	R	Logic Result #33–48
49–64	0–15	R	Logic Result #49–64

Region Programmable Module Constants (PMK)

The Region Programmable Module Constants are:

Record	R/W	Item Description
1–20	W	Module #1 – Constant #K1–K20
21–40	W	Module #2 – Constant #K1–K20
41–60	W	Module #3 – Constant #K1–K20
61–80	W	Module #4 – Constant #K1–K20
81–100	W	Module #5 – Constant #K1–K20
101–120	W	Module #6 – Constant #K1–K20
121–140	W	Module #7 – Constant #K1–K20
141–160	W	Module #8 – Constant #K1–K20
161–180	W	Module #9 – Constant #K1–K20
181–200	W	Module #20 – Constant #K1–K20
201–220	W	Module #11 – Constant #K1–K20
221–240	W	Module #12 – Constant #K1–K20

Region Programmable Module Outputs (PMO)

Setting PMO valves sets an output hold that must be manually reset to allow algorithm control of the point. See *Releasing DX9100 Output Holds* for details.

Record	R/W	Item Description
1–8	W	Module #1 Output – Channel #1–8
9–16	W	Module #2 Output – Channel #1–8
17–24	W	Module #3 Output – Channel #1–8
25–32	W	Module #4 Output – Channel #1–8
33–40	W	Module #5 Output – Channel #1–8
41–48	W	Module #6 Output – Channel #1–8
49–56	W	Module #7 Output – Channel #1–8
57–64	W	Module #8 Output – Channel #1–8
65–72	W	Module #9 Output – Channel #1–8
73–80	W	Module #10 Output – Channel #1–8
81–88	W	Module #11 Output – Channel #1–8
89–96	W	Module #12 Output – Channel #1–8

Region Programmable Module Logic (PML)

Setting PML valves sets an output hold that must be manually reset to allow algorithm control of the point. See *Releasing DX9100 Output Holds* for details.

Record	R/W	Item Description
1–8	W	Module #1 DO – Channel #1–8
9–16	W	Module #2 DO – Channel #1–8
17–24	W	Module #3 DO – Channel #1–8
25–32	W	Module #4 DO – Channel #1–8
33–40	W	Module #5 DO – Channel #1–8
41–48	W	Module #6 DO – Channel #1–8
49–56	W	Module #7 DO – Channel #1–8
57–64	W	Module #8 DO – Channel #1–8
65–72	W	Module #9 DO – Channel #1–8
73–80	W	Module #10 DO – Channel #1–8
81–88	W	Module #11 DO – Channel #1–8
89–96	W	Module #12 DO – Channel #1–8

Region Programmable Module Accumulator (PMA)

The Region Programmable Module Accumulators are:

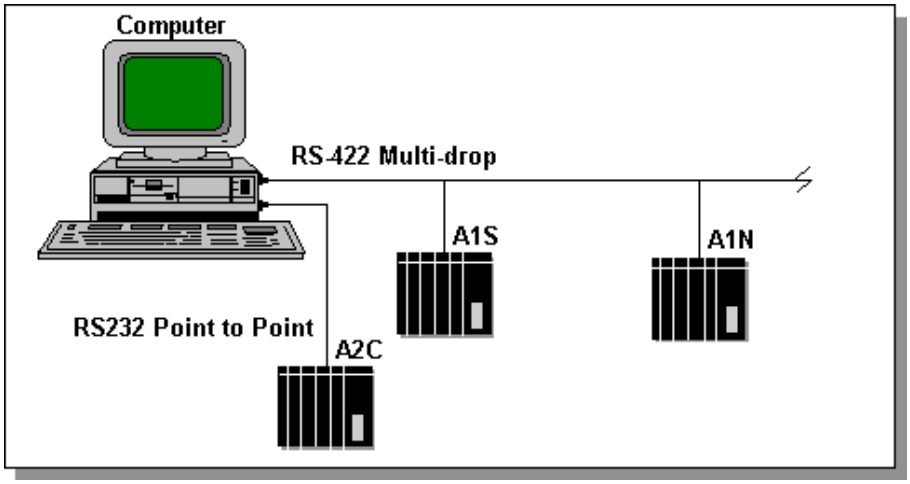
Record	R/W	Item Description
1–8	W	Module #1 Accumulator – Channel #1–8
9–16	W	Module #2 Accumulator – Channel #1–8
17–24	W	Module #3 Accumulator – Channel #1–8
25–32	W	Module #4 Accumulator – Channel #1–8
33–40	W	Module #5 Accumulator – Channel #1–8
41–48	W	Module #6 Accumulator – Channel #1–8
49–56	W	Module #7 Accumulator – Channel #1–8
57–64	W	Module #8 Accumulator – Channel #1–8
65–72	W	Module #9 Accumulator – Channel #1–8
73–80	W	Module #10 Accumulator – Channel #1–8
81–88	W	Module #11 Accumulator – Channel #1–8
89–96	W	Module #12 Accumulator – Channel #1–8

Mitsubishi A-Series Serial Communications

About Mitsubishi A-Series Serial Communications

The Mitsubishi® A-Series Serial communications supports Mitsubishi A-Series programmable controllers in point-to-point and multi-drop configurations with one master device where the CIMPLICITY Mitsubishi A-Series Serial Communication enabler acts as the master. The Mitsubishi A-Series Serial Communications provides read and write access to the Mitsubishi programmable controllers via the Mitsubishi dedicated ASCII protocol using format 2 as documented in the Mitsubishi *COMPUTER LINK MODULE Users Manual*.

The Mitsubishi A-Series programmable controllers support Computer Link Modules designed to allow a computer serial access to data in the programmable controllers (some A-Series CPU models have built in Computer Link port interfaces). Depending on the CPU and/or the Computer Link Module, you can make either RS-232 point to point connections or RS-422 multi-drop connections. You can connect up to 32 Mitsubishi programmable controllers to a host computer via multi-drop RS-422 line. Each programmable controller connected to the host can act as a gateway to MELSECNET or MELSECNET/B and provide access to the programmable controllers connected to this proprietary Mitsubishi network. Up to 64 programmable controllers on a MELSECNET(/B) can be accessed through each gateway.



Supported Mitsubishi A-Series Devices

The Mitsubishi A-Series Serial Communications enabler supports communications to the following programmable controllers:

A0J2H	**A2**	**A2C**	**A3M**
A1	**A2 S1**	**A2N**	**A3N**
A1N	**A2A**	**A2N_S1**	
A1S	**A2A S1**	**A3**	

Supported Mitsubishi A-Series Memory (Device) Areas

The Mitsubishi programmable controllers contain multiple data areas that consist of channels of 16-bit data, discrete bit data, and completion bit data (timers and counters). In Mitsubishi terminology, these areas are referred to as device areas and the points within as devices. Device types include discrete I/O, Relays, Contacts, Coils and Registers. The type of areas and number of devices depends on the Mitsubishi programmable controller model. The amount of data read and returned to CIMPLICITY HMI software is determined by the Point Type configured for the device type you select.

All communication commands are implemented as master/slave communications where the CIMPLICITY Mitsubishi A-Series Serial Communications enabler acts as the master responsible for requesting data from or writing data to Mitsubishi programmable controller(s). Unsolicited data sent from Mitsubishi programmable controllers is not supported.

The memory areas supported by the CIMPLICITY Mitsubishi A-Series Serial Communications enabler are:

Bit Device Area	**Word Device Area**
Input X	Timer (present value) T
Output Y	Counter (present value) C
Internal Relay M	Data Register D
Latch Relay L	Link Register W
Step Relay S	File Register R
Link Relay B	Special Register D
Annunciator F	Buffer Memory
Special Relay M	
Timer Contact TS	
Time Coil TC	
Counter Contact CS	
Counter Coil CC	

Mitsubishi A-Series Required Documents

In order to properly configure Mitsubishi programmable controller(s) and their Computer Link Module(s) you must refer to the Operations and System manuals for the appropriate programmable controller. If a Computer Link Module is used, then the User's Manual for that interface is required.

These manuals contain important information on:

- Setting the Computer Link port's communication parameters such as address, communication speed and parity.
- Constructing the proper RS-232 and RS-422 cable(s) for connecting the CIMPLICITY computer to the programmable controllers.
- Interpreting response codes returned from programmable controllers and reported to the Status Log.

Mitsubishi Hardware Configuration Requirements

Mitsubishi programmable controllers are connected via RS-232 or RS-422 connections to either the Mitsubishi programmable controller's built in Computer Link interface port or through an optional Computer Link Module. Up to 32 Mitsubishi programmable controllers can be connected to a host computer via RS-422 communications on a local network (additional programmable controllers can be accessed though programmable controllers acting as gateways to MELSECNET or MELSECNET/B).

Supported Computer Link Modules

The following Computer Link modules can be used with the given programmable controller models:

- AnA and AnN Series via AJ71C24-S8 (RS-232 and RS-422), AJ71UC24 or equivalent
- A1S Series via A1SJ71C24-R2 (RS-232) or A1SJ71C24-R4 (RS-422) or equivalent
- A2CCPUC24 and A2CCPUC24-PRF via internal computer link modules supporting both RS-232 and RS-422

The choice of modules should be based on your Mitsubishi programmable controller models and system requirements (multi-drop or single, point to point). Please consult Mitsubishi documentation on the features and uses of each of the listed interface modules.

If the Mitsubishi programmable controllers are to be connected via RS-422 then you may need an RS-232 to RS-422 converter or RS-422 cards for your computer. It is recommended that you contact Mitsubishi to determine the best converter for your configuration.

Default Communication Parameters

The following communication parameters used by the CIMPLICITY Mitsubishi A-Series Serial Communication enabler cannot be changed. The A-Series Serial modules in the PLC must be configured to match these settings:

Parameter	Value	Description
Data Bits	7	Number of data bits used in transmissions
Stop Bits	1	Number of stop bits used in transmissions

The following communication parameters must match the Port configuration parameters for the CIMPLICITY Mitsubishi A-Series Serial Communication enabler:

- Baud Rate
- Parity

Mitsubishi A-Series PLC Cable Diagrams

The following diagrams are intended to provide general guidance for the construction of the cable used to connect your CIMPLICITY HMI computer to the Computer Link port on a Mitsubishi A-Series PLC.

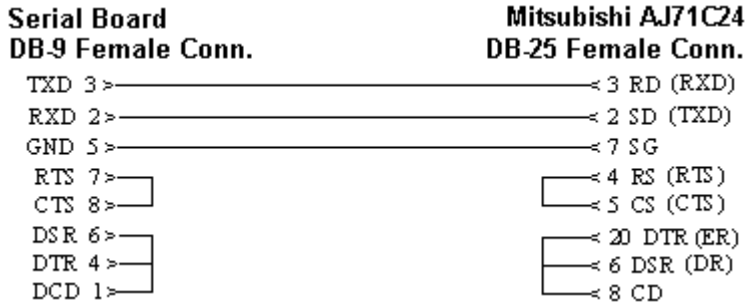
Always refer to the appropriate A-Series programmable controller and/or Computer Link Module User's Manual that came with your system for detailed diagrams for your particular adapter model and network configuration.

RS-232 Interface Cables

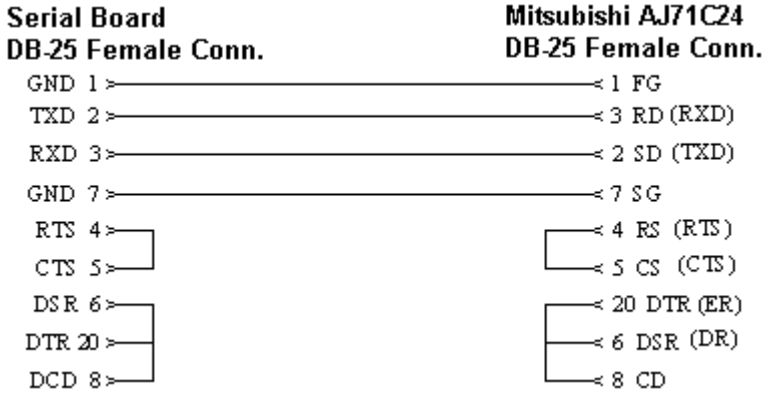
The cabling diagrams below illustrate the interfaces for:

- Serial board DB-9 female connector to Mitsubishi AJ17C24 DB-25 female connector
- Serial board DB-25 female connector to Mitsubishi AJ17C24 DB-25 female connector
- Serial board DB-9 female connector to Mitsubishi AJ17C24 DB-9 female connector
- Serial board DB-25 female connector to Mitsubishi AJ17C24 DB-25 female connector

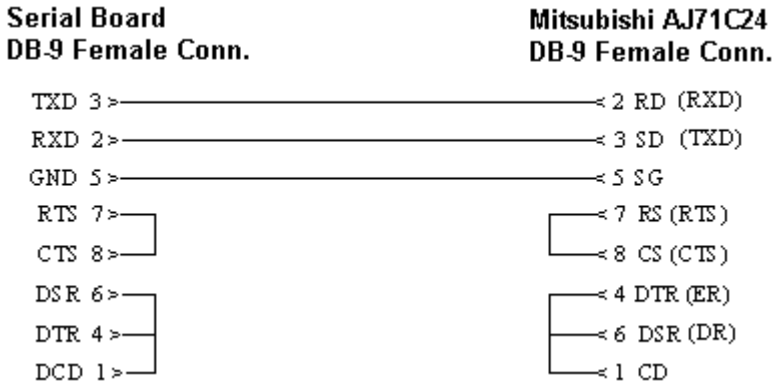
Serial Board DB-9 Connector to DB-25 Connector



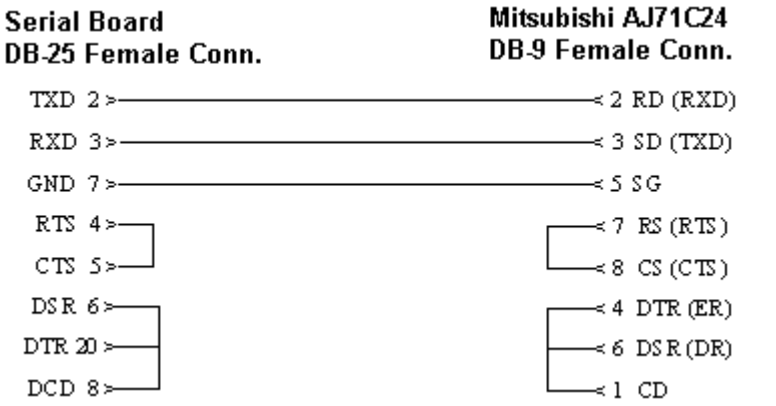
Serial Board DB-25 Connector to DB-25 Connector



Serial Board DB-9 Connector to DB-9 Connector



Serial Board DB-25 Connector to DB-9 Connector

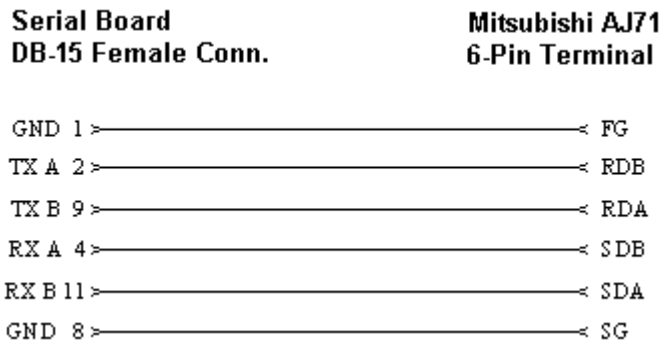


RS-422 Interface Cables

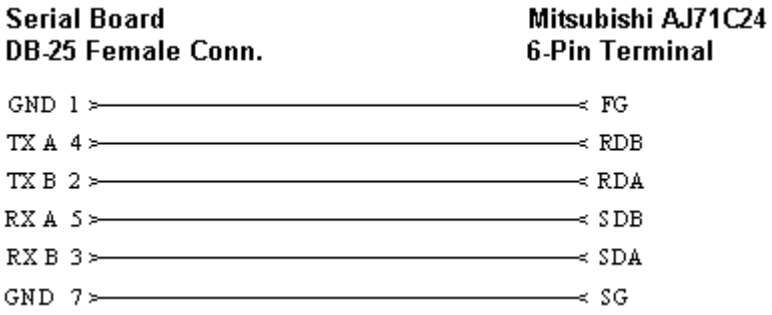
The cabling diagrams below illustrate the interfaces for:

- Serial board DB-15 female connector to Mitsubishi AJ17C24 6-pin terminal
- Serial board DB-25 female connector to Mitsubishi AJ17C24 6-pin terminal

Serial Board DB-15 Connector to 6 Pin Terminal



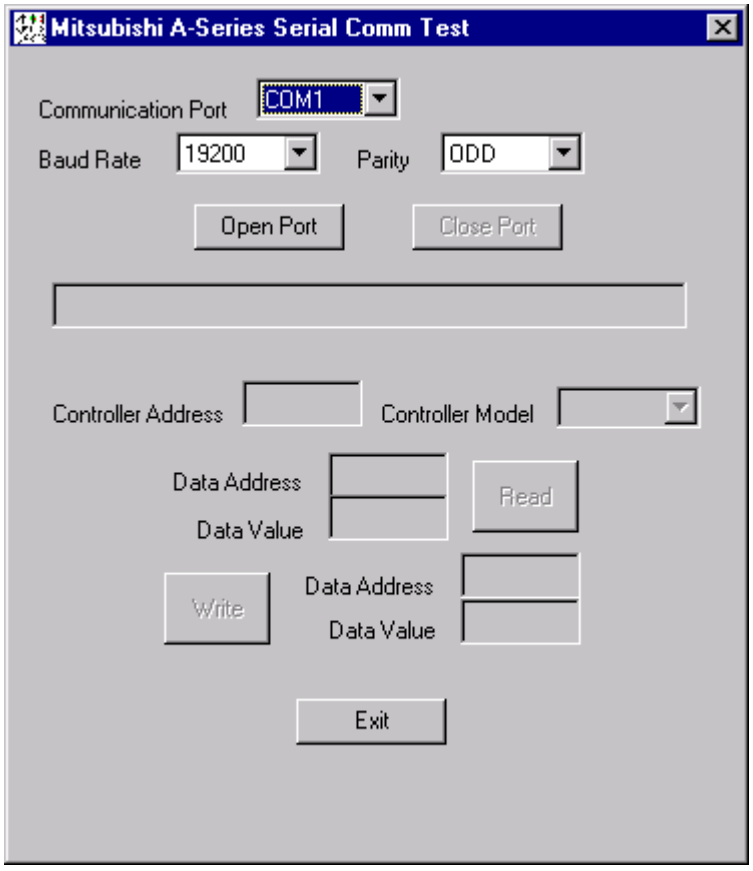
Serial Board DB-25 Connector to 6 Pin Terminal



Validating Mitsubishi A-Series Serial Communications

You can use the Mitsubishi A-Series Serial Diagnostics program to check the basic configuration, cabling and operation of your network without running a CIMPLICITY project. You can use this program to read data from and write data to a specified Mitsubishi programmable controller. A single value (channel or timer/completion bit) is transferred at a time.

To start the Mitsubishi A-Series Serial Diagnostics program, select the *Mitsubishi A-Series Serial Diagnostics* icon in the CIMPLICITY HMI program group. The *Mitsubishi A-Series Serial Comm Test* dialog box opens with default parameters selected.



The top section of the dialog contains fields for setting the communication port parameters. A display only field in the center of the dialog displays error and status information. Below the status message field are fields you can use to specify the programmable controller Address, Data Address and Data Values for read and write testing

Opening A Communication Port

To test communication with a Mitsubishi programmable controller you first select its communication port, baud rate and parity. To do this:

1. In the **Communications port** field, select the communication port for the PLC.
2. In the **Baud rate** field, select the baud rate for the programmable controller.
3. In the **Parity** field, select the parity for the programmable controller.
4. Select **Open port** to initialize communications

The status of your request is displayed in the message field.

If an error message is displayed, check that the selected communication port is not in use by another program and that the port is properly configured and available on the PC and operating system.

Selecting A Target Programmable Controller

This is the same format you use when defining a device address in CIMPLICITY software

After you open the communication port, you can select the Mitsubishi programmable controller you want to test. To do this, enter the device's address in the **Controller Address** field.

- For programmable controllers attached directly to your computer either point to point via RS-232 or on an RS-422 link, enter the programmable controller's Station Number, using the following format:

  `<station number>`

  where **`<station number>`** is a hexadecimal number with a valid range of 0 to 1F.

  Examples of local addresses are: 1A and 2

- For programmable controllers on a MELSECNET or MELSECNET/B subnetwork to be accessed via a programmable controller connected to your computer, use the following format:

  `<station number>.<PC CPU number>`

  where **`<station number>`** is the station number of the programmable controller on the local serial network acting as the MELSECNET(/B) gateway and **`<PC CPU number>`** is the address assigned to the data link module attached to MELSECNET(/B).

  Entries are in hexadecimal with a valid range of 0 to 1F for the station number and 0 to 40 for PC CPU number.

  Examples of MELSECNET addresses are: 3.10, A.1A, and 0.1

If you enter an invalid programmable controller address, an error message displays on the status line. You must enter a valid address to continue.

After you enter a valid programmable controller address, make a selection in the **Controller Model** field. You can click on the down arrow beside the field to view the list of valid selections. Once you select a controller model, the Read and Write **Data address** fields are enabled.

Reading Data

You can read data from valid data areas. Valid data areas are determined by the programmable controller type. The format for entering a data address is the same one you use when you configure points for a CIMPLICITY HMI project.

To read data from the targeted programmable controller:

1. Enter the address of the data in the **Data address** field to the left of the **Read** button. This activates the **Read** button
2. Select **Read**.

If the read request completes successfully, the data appears in the **Data value** field and the status message field says the read was successful. All read data is displayed in hexadecimal. Bit type data such as discrete I/O, Timer Contact, Time Coil, Counter Contact and Counter Coil are displayed as 1 or 0.

If the read request fails, an error message is displayed in the status message field.

Writing Data

You can write data to valid data areas. Valid data areas are determined by the programmable controller type. The format for entering a data address is the same one you use when you configure points for a CIMPLICITY HMI project.

To write data to the targeted programmable controller:

1. Enter a valid data address in the **Data address field** to the right of the **Write** button. This activates the **Data value** field.
2. Enter the data you want to write in the **Data value** field. Enter data values for word devices in hexadecimal notation and enter 1 or 0 for bit device data. This activates the **Write** button.
3. Select **Write**.

The status message field displays a message indicating the success or failure of the write request.

The status line will display a message indicating the result of the write operation, either successful or, in the case of a failure, an error message.

Diagnosing Communication Problems

If the read or write request fails, a message is displayed in the status message field giving an indication of the failure. Use this information to help diagnose communication problems. Error messages will include the Error Code returned from the target programmable controller where appropriate. Refer to the Mitsubishi A-Series programmable controller's or Computer Link Module's User Manuals for complete error descriptions. Errors will indicate possible problems with data addresses, data ranges, etc.

Time-out Errors

Time-out errors may indicate an invalid programmable controller address, incorrect communication parameters settings, or communication port problems. The most common cause of time-out errors is an improperly constructed communication cable.

Closing Communication Port and/or Changing Ports and Configuration

You need to close communications when:

- You are finished with diagnostic testing
- You want to select a different port
- You want to change the port's baud rate or parity.

To close communications, select **Close port**.

Exiting the Diagnostic Program

To exit the Mitsubishi A-Series Serial Diagnostics program:

1. Select **Close port** to close and release the communication port.
2. Select **Exit** to close the dialog and terminate the program.

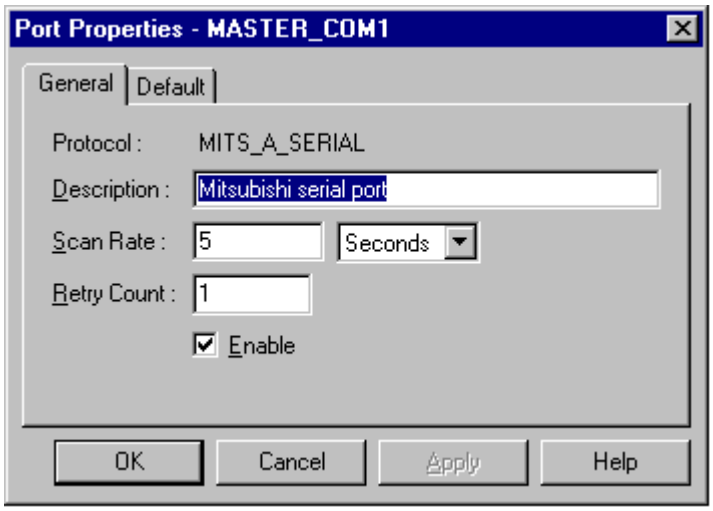
Mitsubishi A-Series Serial Communications Application Configuration

When you configure ports, devices and points that use the Mitsubishi A-Series Serial Communications enabler, some field must contain unique values for the communications to work successfully. These are detailed below.

Port Configuration

When you configure a port for Mitsubishi A-Series Serial communications, the *Port Properties* dialog box for the protocol opens. You can set general and default properties for the port.

General Properties

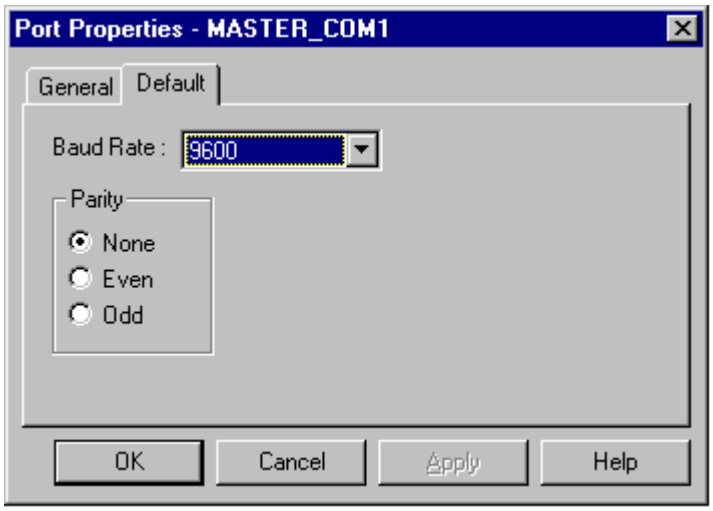


Use the *General* properties to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, or **Hours**.
Retry Count	If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it. Enter the number of scans to wait before attempting to reconnect to a device after a communication error has been detected. The recommended **Retry Count** is 3.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Default Properties



Use the *Default* properties to enter communications information for the port. You can define the following:

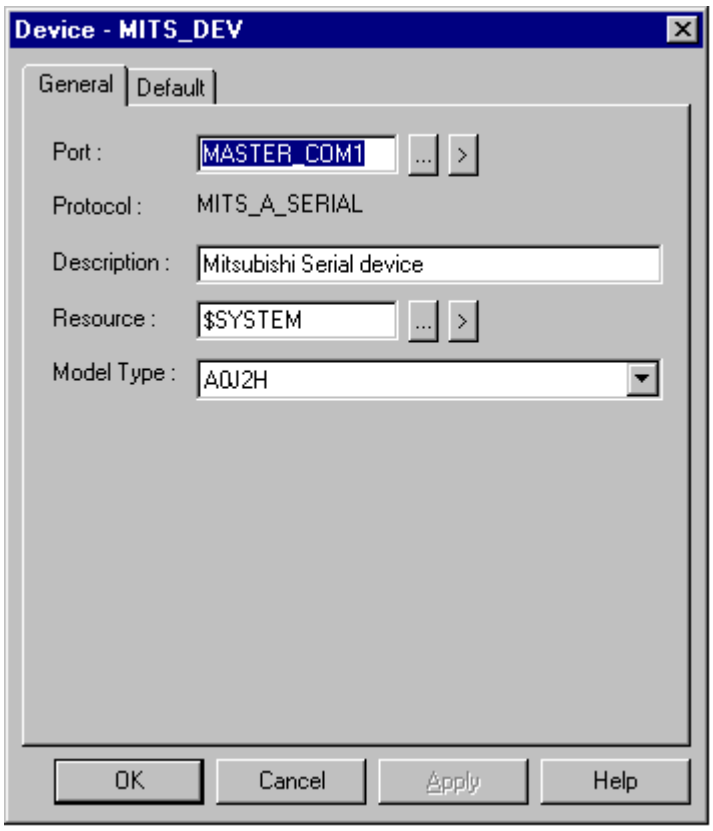
Baud Rate Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.

Parity Select the parity to be used for the communications.

Device Configuration

When you configure a Mitsubishi programmable controller for Mitsubishi A-Series Serial communications, the *Device Properties* dialog box for the devices using this protocol opens.

General Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port — Select the port for this device.

- You can click the Browser button - ... - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - > - to create a new port, edit the current port, or select a port from the list of ports.

Description — Enter an optional description to help you identify the device.

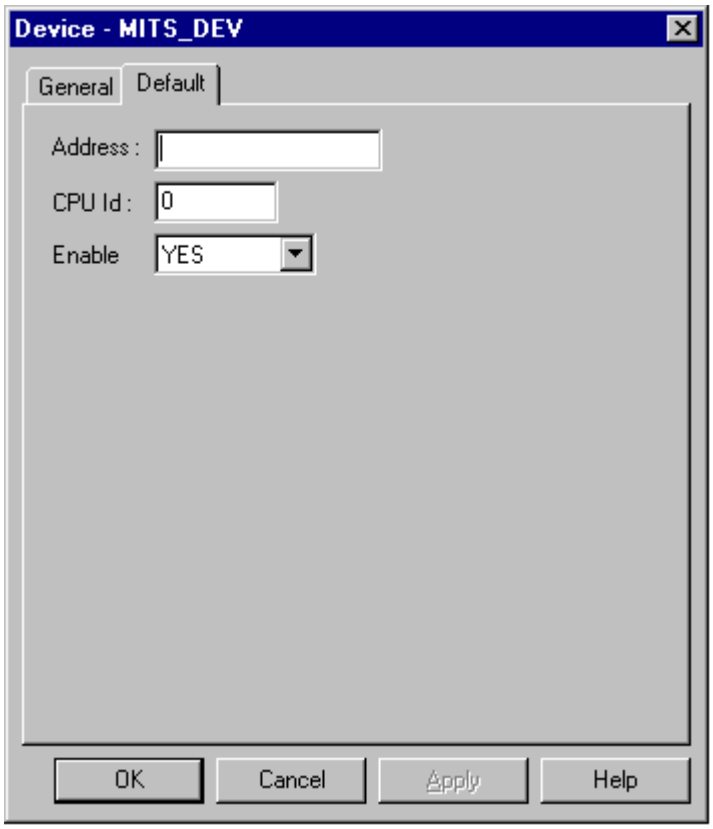
Resource — Enter a resource that can be associated with this device for alarm generation.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices. For Mitsubishi A-Series Serial Communications, the choices are:

A0J2H	**A2**	**A2C**	**A3M**
A1	**A2 S1**	**A2N**	**A3N**
A1N	**A2A**	**A2N_S1**	
A1S	**A2A S1**	**A3**	

When you select the **Model Type**, you identify acceptable data addresses for each memory (device) type. This information is used to validate data addresses during point configuration.

Default Properties



Use the *Default* properties to enter addressing information about this device.

Address Enter the controller's address. The address is one of the following:

- For target programmable controllers attached directly either point to point via RS-232 or on an RS-422 link, enter the programmable controller's Station Number

  <station number>

  where **<station number>** is in hexadecimal with a valid range of 0 to 1F.

  Examples of local addresses are: 1A and 2

- For programmable controllers on a MELSECNET or MELSECNET/B subnetwork to be accessed via a locally connected programmable controller, use the following format:

  <station number>.<PC CPU number>

  where **<station number>** is the station number of the programmable controller on the local serial network acting as the MELSECNET(/B) gateway and **<PC CPU number>** is the address assigned to the data link module attached to MELSECNET(/B).

  Entries are in hexadecimal with a valid range of 0 to 1F for the station number and 0 to 40 for PC CPU number.

  Examples of MELSECNET addresses are: 3.10, A.1A, and 0.1

CPU ID *Not used.*

Enable Select **YES** to enable the device when the project starts. Select **NO** to disable the device. If you select **NO**, the device will not be enabled and points associated with the device will be unavailable.

Point Configuration

Once your devices are configured, you may configure points for them. Through device point configuration, you may configure the following:

- Points that read or set discretes and/or bits in bit type memory (device) areas
- Points to read or set word in word type memory (device) areas
- Points to read Timer/Counter Coils and Contacts
- Points to read or set Timer and Counter Present Values

The fields described below have configuration values that are unique to, or have special meaning for Mitsubishi A-Series Serial communications.

Access

The type of access depends on the point address.

Enter **READ** for points configured for Inputs.

Enter **READ or WRITE** for all other points if you wish to be able to set (change) the value.

Update Criteria

The update criteria determines how the data will be requested.

Enter **On Change** or **On Scan** for points whose values should be polled by the Mitsubishi A-Series Serial communications at regular intervals.

Enter **On Demand On Scan** or **On Demand On Change** for points whose value should be polled by the Mitsubishi A-Series Serial communications at regular intervals while users are viewing them.

Address

Enter the point address of the data. Point addresses are device-dependent. See the *Address Formats* section below for more information

When you configure DIGITAL points from non-discrete memory (such as D, Data Registers), you must also enter data in the following field:

Bit Offset

Enter the bit offset in the 16-bit memory word that defines the point where 0 is the least significant bit and 15 is the most significant bit.

Warning

Do not enter a data Bit Offset for Point Type BOOL for Bit type devices such as Input (X), Output (Y), Internal Relay (M), Timer Contact, Timer Coil, etc. Leave the field as the default 0.

Address Formats

The following table lists each of the memory (device) areas accessible by the Mitsubishi A-Serial Serial interface.

The Address Entry column gives the *maximum* device number that a particular device area could support. The actual allowed for the programmable controller being configured may be less and is dependent upon the model.

The Entry Type column specified how you should enter the device's number. Some devices are numbered/referenced by decimal numbers and others by hexadecimal.

The last column specifies how the interface treats the device area, either as bit (discrete) devices or as word devices.

Device Area	Address Entry	Entry Type	Device Type
Input (Read Only)	X000000 to X0007FF	Hexadecimal	Bit
Output	Y000000 to Y0007FF	Hexadecimal	Bit
Internal Relay M	M000000 to M008191	Decimal	Bit
Latch Relay L	L000000 to L008191	Decimal	Bit
Step Relay S	S000000 to S008191	Decimal	Bit
Link Relay B	B000000 to B000FFF	Hexadecimal	Bit
Annunciator F	F000000 to F002027	Decimal	Bit
Special Relay M	M009000 to M009255	Decimal	Bit
Timer (contact) T	TS00000 to TS02047	Decimal	Bit
Timer (coil) T	TC00000 to TC02047	Decimal	Bit
Counter (contact) C	CS00000 to CS01023	Decimal	Bit
Counter(coil) C	CC00000 to CC01023	Decimal	Bit
Timer (present value) T	TN00000 to TN02047	Decimal	Word
Counter (present value) C	CN00000 to CN02047	Decimal	Word
Data Register D	D000000 to D006143	Decimal	Word
Link Register W	W000000 to W000FFF	Hexadecimal	Word
File Register R	R000000 to R008191	Decimal	Word
Special Register D	D009000 to D009255	Decimal	Word
Buffer Memory	BM00000 to BM00DFF	Hexadecimal	Word

Notes on Addressing

Please note the following about point addresses for the Mitsubishi A-Series Serial Communications enabler:

- Letters in address entries can be upper or lower case
- Leading zeros on address numbers are optional. Example: X003 is treated the same as X3.
- Device with hexadecimal addressing may be specified in decimal by prefacing the number with D or d. Example: X00A can be entered as X0d10, XD10, X0D10, etc.
- Address ranges may be limited by the address space available in the particular controller model.
- Use BOOL Point Types for devices with Device Type Bit.
- Do not use the Offset field (leave it with the default value of 0) for devices with Device Type Bit.

Adjusting the Communications Time-out Parameter

The communications time-out parameter used by the Mitsubishi A-Series Serial Communications enabler is set to a default value of 7.5 seconds. You can change this parameter in CIMPLICITY HMI software. To do this, add the following record to the Global Parameters file:

```
COM<port>_TO|1|<value>
```

where **<port>** is the communication port number and **<value>** is the time out in *tenths* of seconds. For example,

```
COM1_TO|1|105
```

sets the time out for communications on port COM1 to 10.5 seconds.

For more information on configuring global parameters, see Global Parameters in the *CIMPLICITY HMI for Windows NT and Windows 95 Base System User Manual* (GFK-1180).

Default Protocol Parameters

Certain protocol parameters used by the Mitsubishi A-Series Serial Communications enabler have been preset. They are:

Message Wait Time

Preset value = 0

Unit Address - 0 indicates the programmable controller's CPU. This is not the same as the unit number (that is, node number) which is configurable.

PC CPU

Preset value = FF

Default PC CPU number used for addresses entered as **<station number>** only.

If **<station number>.<PC CPU number>** format is used, then the entered **<PC CPU number>** is used instead of FF.

Mitsubishi TCP/IP Communications

About Mitsubishi TCP/IP Communications

The Mitsubishi TCP/IP Communications enabler lets you exchange data between Mitsubishi Melsec programmable controllers using TCP/IP protocol and CIMPLICITY HMI projects.

This communications module requires that an Ethernet card be installed and configured in your CIMPLICITY HMI project. In addition, TCP/IP communications must be configured on your computer.

Mitsubishi TCP/IP Supported Devices

The Mitsubishi TCP/IP communications enabler supports the following devices:

- Mitsubishi Melsec-A0J2H
- Mitsubishi Melsec-A1
- Mitsubishi Melsec-A1N
- Mitsubishi Melsec-A1S
- Mitsubishi Melsec-A1SJ
- Mitsubishi Melsec-A1S_S1
- Mitsubishi Melsec-A2
- Mitsubishi Melsec-A2_S1
- Mitsubishi Melsec-A2A
- Mitsubishi Melsec-A2A_S1
- Mitsubishi Melsec-A2AS
- Mitsubishi Melsec-A2AS_S1
- Mitsubishi Melsec-A2C
- Mitsubishi Melsec-A2N
- Mitsubishi Melsec-A2N_S1
- Mitsubishi Melsec-A2S
- Mitsubishi Melsec-A2S_S1
- Mitsubishi Melsec-A2U
- Mitsubishi Melsec-A2U_S1
- Mitsubishi Melsec-A3
- Mitsubishi Melsec-A3A
- Mitsubishi Melsec-A3AU
- Mitsubishi Melsec-A3M
- Mitsubishi Melsec-A3N
- Mitsubishi Melsec-A3U
- Mitsubishi Melsec-A3X
- Mitsubishi Melsec-A4U

An Ethernet Interface Module type AJ71E71 or A1SJ71E71-B2 must be installed in the programmable controller.

Communications to these devices is only available when the devices are in **RUN** mode.

Mitsubishi TCP/IP Supported Memory Types

The Mitsubishi TCP/IP communications enabler supports reading and writing to the following memory types:

Data Register

Link Register

Files Register

Input

Output

Internals

Link Relay

Annunciator

Random Access

Mitsubishi TCP/IP Hardware Configuration Requirements

An Ethernet Interface Module type AJ71E71 or A1SJ71E71-B2 must be installed in the programmable controller. These modules have switches that you may want to change from the factory settings.

A1SJ71E71-B2 Settings

For the A1SJ71E71-B2 module, the switches of interest are:

Switch	Setting	Description
SW1	OFF	Line is closed when TCP time-out occurs
	ON	Line is not closed when TCP time-out occurs
SW2	OFF	Use binary communications
	ON	Use ASCII communications
SW3	OFF	Writes to the programmable controller are disabled when CPU is in RUN state
	ON	Writes to the programmable controller are enabled when CPU is in RUN state
SW4	OFF	Start initial processing immediately when a message is received (quick start)
	ON	Start initial processing 20 seconds after delay time when a message is received (normal start)

Note

All switches are set to the OFF position in the factory.

AJ71E71 Settings

For the AJ71E71 module, the switches of interest are:

Switch	Setting	Description
SW1	OFF	Line is closed when TCP time-out occurs
	ON	Line is not closed when TCP time-out occurs
SW2	OFF	Use binary communications
	ON	Use ASCII communications
SW7	OFF	Writes to the programmable controller are disabled when CPU is in RUN state
	ON	Writes to the programmable controller are enabled when CPU is in RUN state
SW8	OFF	Start initial processing immediately when a message is received (quick start)
	ON	Start initial processing 20 seconds after delay time when a message is received (normal start)

Note

Switches 3-6 are not currently used. All switches are set to the OFF position in the factory.

Mitsubishi TCP/IP Related Documents

You should have the following documentation available when configuring this interface:

Mitsubishi Melsec Programmable Controller - A User's Manual - Ethernet Interface Module type AJ71E71 with a Revision of July, 1993 or later.

The ***Mitsubishi User's Guide*** for your model of programmable controller.

In addition, the following Mitsubishi manual are recommended:

ACPU Programming Manual (Fundamentals) - IB(NA)?66249

ACPU Programming Manual (Common Instructions) - IB(NA)?66250

The following application note is recommended:

Developer's Guide For Mitsubishi Ethernet Module Using the AJ71E71 by Albert G. Baier.

To obtain a copy of this application note, please contact your Mitsubishi distributor and request that they obtain this document for you from Mitsubishi Electronics America, Industrial Automation Division

Mitsubishi TCP/IP Communications Configuration Checklist

Prior to using this communications interface, you *must* perform the following steps:

1. Install an Ethernet card in your computer.
2. Configure the minimum TCP/IP Communications for your computer, including assignment of a name and TCP/IP address for the computer.
3. Assign a TCP/IP address for each Mitsubishi Melsec-A programmable controller. If you are on a company-wide or standardized network, you should obtain your TCP/IP addresses from your network administrator
4. For each programmable controller communicating with CIMPLICITY HMI software via Ethernet, assign a Socket port number for the connection. If you are on a company-wide or standardized network, you should obtain your Ethernet port number from your network or system administrator.
5. Configure the TCP/IP address for each Mitsubishi Melsec-A programmable controller on your computer.

   In the Windows NT operating system, use the

   `\WINNT\System32\drivers\etc\hosts`

   file for the configuration.

   In the **`hosts`** file, add one line for each Mitsubishi Melsec-A programmable controller in the following format:

   `<IP_address> <PLC_name> <PLC_alias>`

   Note that each field is separated by at least one space. For example, if the IP address configured for the Mitsubishi Melsec-A programmable controller is 1.2.3.4 and the name for the PLC is "MELSEC", the line in the hosts file for this controller will be:

   `1.2.3.4 MELSEC melsec`
6. On each programmable controller, configure the host address for the programmable controller as well as assign the Internet address *and* socket port number to a connection. Please refer to the required documents above for assistance in developing the needed ladder logic
7. Use the Mitsubishi TCP/IP test program to check the configuration of your network without starting a CIMPLICITY HMI project.

Using the Mitsubishi TCP/IP Test Program

You can use the Mitsubishi TCP/IP test program (**melsec_diag.exe**) to check the configuration of your network without starting CIMPLICITY HMI software.

To invoke the test program:

1. Open your project's *Configuration* cabinet.
2. Select **Command Prompt...** from the **Tools** menu to open an MS-DOS window.
3. In the MS-DOS window, type the following at the MS-DOS prompt:

   melsec_diag <host_name> <socket_port_number

   where **<host_name>** is the name of the Mitsubishi PLC in the **hosts** file and **<socket_port_number>** is the socket port number you assigned to the PLC.

If the test succeeds, you will see output with the following format:

```
Socket port: <socket_port number>
<computer_name> is connected to <host_name> PLC.
Communication between <computer_name> and <host_name> PLC is
disconnected (normal exit).
```

For example, if the computer name is *ABC123*, the PLC name is *MELSEC* and the configured socket port number for the PLC is 1234, the MS-DOS command is:

```
melsec_diag MELSEC 1234
```

and the output is:

```
Socket port: 1234
ABC123 is connected to MELSEC PLC.
Communication between ABC123 and MELSEC PLC is disconnected (normal
exit).
```

If the test fails, then the error message will be displayed following the socket port number. In this case, check your Ethernet connections, ladder logic, and computer configuration to ensure that all are set correctly. Any inconsistency will prevent successful communication.

In addition, the Mitsubishi TCP/IP diagnostic program has been enhanced to validate device point addresses. Previously, only device connectivity could be validated. To use the diagnostic program, open a command prompt from the Project's Configuration Cabinet and issue the following command:

melsec_diag <host_name> <socket_port_number> <cpu_id> <address> <length> <communication mode>

where:

<**host_name**> = name of the Mitsubishi PLC in the **hosts** file

<socket_port_number> = socket port number you assigned to the PLC

<**cpu_id**> = PC CPU assigned to the Mitsubishi PLC (value in decimal)

<**address**> = device point address (for detail on format, refer to Application Configuration section of the Mitsubishi TCP/IP Documentation)

<**length**> = number of bytes to be read

<**communication mode**> = A (for ASCII) or B (for Binary)

The following example can be used to validate reading 2 bytes from Extension File Register/block 0 in binary communication mode. Assume the computer name is **ABC123,** the PLC name is **MELSEC**, the PC CPU value of FF(h) or **255** (decimal), the port number is **1234**. To read the Register, the MS-DOS command is:

```
melsec_diag MELSEC 1234 255 r0 2 B
```

and the output is:

```
PLC Name: MELSEC, Port Number: 1234
ABC123 is bound to the socket.
ABC123 is connected to MELSEC.
Parameters entered for reading data from MELSEC:
    Address: r0, length: 2(bytes), cpu id: 255, communication mode:
B

Send BINARY command to PLC:
    0x17 0xffffffff 0x00 0x02 0x00 0x00 0x00 0x00 0x20 0x52 0x00
0x00
Read 4 bytes from PLC:
    0xff97 0x00 0x01 0x00

Communication between ABC123 and MELSEC is closed (normal exit).
```

Mitsubishi TCP/IP Application Configuration

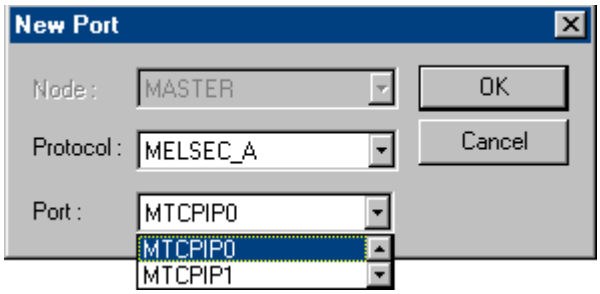
As with other CIMPLICITY HMI software communications enablers, you must complete the Port, Resource, Device and Device Point Configuration to setup the Mitsubishi TCP/IP Communications.

For more information on port, device, and point configuration functions, see the *CIMPLICITY HMI Base System User's Manual* (GFK-1180).

Mitsubishi TCP/IP Port Configuration

When you configure a port for Mitsubishi TCP/IP communications, the *New Port* dialog opens.

New Port



Select the **Protocol** used by the programmable controller:

For ASCII communications, select *MELSEC_A*.

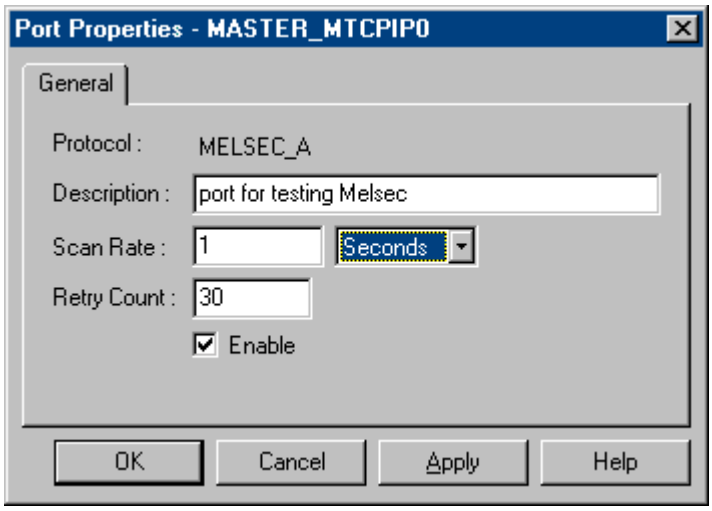
For Binary communications, select *MELSEC _B*.

Note

SW2 controls the mode of communication on the programmable controller:
On = ASCII
Off = binary
If you change the position of the switch, the change does *not* take effect until the controller has been reset.

Make sure that one of the Port names is selected. Select **OK** to display the *Port Properties* dialog for the protocol.

Mitsubishi TCP/IP General Port Properties



Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description — Enter an optional description to help you identify the port.

Scan Rate — Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count — If communications cannot be established to a device on this port, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connection to it.

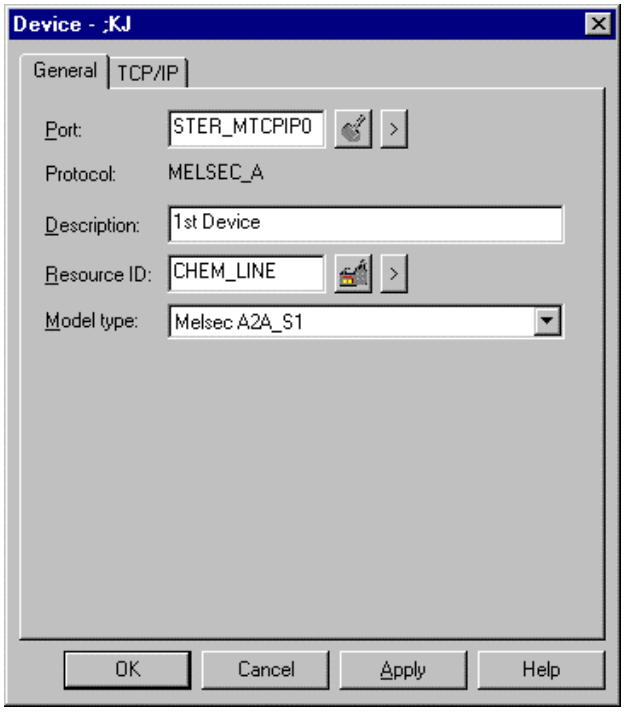
Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.

Enable — Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Mitsubishi TCP/IP Device Configuration

When you configure a Mitsubishi TCP/IP device, the *Device Properties* dialog for devices using this protocol opens.

Mitsubishi TCP/IP General Device Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port — Select the port for this device.

- You can click the Browser button - - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - - to create a new port, edit the current port, or select a port from the list of ports.

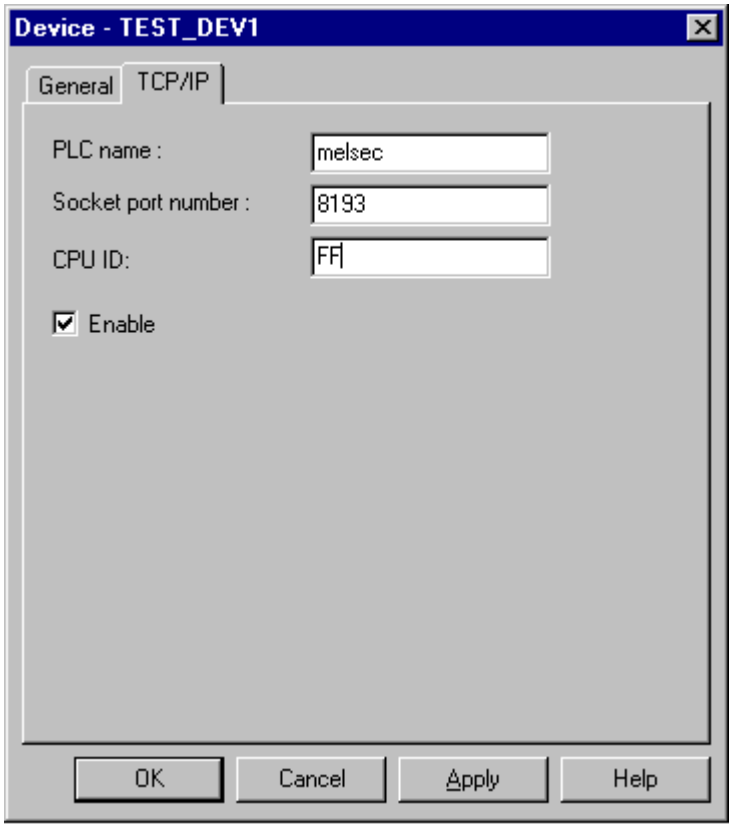
Description — Enter an optional description to help you identify the device.

Resource — Enter a resource that can be associated with this device for alarm generation.

Model type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the choices are:

A0J2H	**A2A_S1**	**A2U_S1**
A1	**A2AS**	**A3**
A1N	**A2AS_S1**	**A3A**
A1S	**A2C**	**A3AU**
A1SJ	**A2N**	**A3M**
A1S_S1	**A2N_S1**	**A3N**
A2	**A2S**	**A3U**
A2_S1	**A2S_S1**	**A3X**
A2A	**A2U**	**A4U**

Melsec Device Properties



Use the *Melsec* properties to enter information about communications for the device. You can define the following:

PLC name Enter the name of the PLC. Use the same name that you configured in the `hosts` file.

Socket port name Enter the socket port number you configured on the PLC.

CPU ID

Mitsubishi TCP/IP communications can communicate directly with a PLC with an AJ71E71 interface card or a Local Station PLC connected via MELSECNET. Enter the CPU ID as a hexadecimal number. The following values are valid:

FF	Use when communicating directly with a PLC with AJ71E71 interface card.
0	Use to communicate with the MELSECNET Master Station.
1 - 40	Use to communicate with a MELSECNET Local Station. Value indicates station number.

Enable

Set this check box to enable the device when the project starts. If you clear this check box, the device will not be enabled and points associated with the device will be unavailable.

Mitsubishi TCP/IP Point Configuration

Once your devices are configured, you many configure points for them. The fields described below have configuration values that are unique to or have special meaning to Mitsubishi TCP/IP communications.

Mitsubishi TCP/IP General Point Properties

On the General tab in the Point Properties dialog box, you may configure points for **Read** or **Read/Write** access.

Mitsubishi TCP/IP Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria

The update criteria determines how the data will be collected and/or updated in your CIMPLICITY HMI software application.

Enter **On Change** or **On Scan** for points whose values should be polled by Mitsubishi TCP/IP communications at regular intervals.

Enter **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by Mitsubishi TCP/IP communications at regular intervals while users are viewing them.

Enter **Unsolicited** for points that are sent by the programmable controller from the Fixed Buffer.

Address

Enter the point address of the data using the following format:

<DEVICE_TYPE><OFFSET>

For some device types, the offset is a hexadecimal number, while in other cases, the offset is a decimal number.

Use the table below to determine how to specify your device and offset.

Device Name	Device Type	Offset
Data Register	D	Decimal
Link Register	W	Hex
Files Register	R	Decimal
Timer (three types)		
Present Value	TN	Decimal
Contact	TS	Decimal
Coil	TC	Decimal
Counter (three types)		
Present Value	CN	Decimal
Contact	CS	Decimal
Coil	CC	Decimal
Input	X	Hex
Output	Y	Hex
Internals	M	Decimal
Link Relay	B	Hex
Annunciator	F	Hex
Random Access	Z	Hex

Unsolicited Communication via the Fixed Buffer is also supported.

Note on Unsolicited Point Addresses

Unsolicited addresses are referenced with a U followed by a hex offset of 4 digits including leading zeros. For example, U012C is a valid address, while U12C is not. The valid range for the offset is 0000-7FFF. For example, U7FFF is a valid address, while U8000 is not.

For all device types *except* the Fixed Buffer, the address may be entered in any combination of upper and lower case letters. For Fixed Buffer devices, the address *must* be configured with *all uppercase* characters or digits.

Note on Addressing Formats

For Link Register, Input, Output, Link Relay, Annunciator, and Random Access addresses you can also use the following format to define the address in decimal format rather than hexadecimal format:

<DEVICE_TYPE>D<DECIMAL_OFFSET>

Unsolicited addresses can also be specified in a decimal format. Decimal unsolicited addresses are referenced with a UD followed by a decimal offset of 5 digits including leading zeros. For example, UD00800 is a valid address, while UD800 is not. The valid range for the offset is 00000-32767. For example, UD32767 is a valid address, while UD32768 is not.

The Mitsubishi TCP/IP Communications enabler has allows access to Extension File Register data. Previously, for File Register data, the File Register Command was employed. The enhanced enabler now uses the Extension File Register command that provides access to both File Register data and Extension File Register data. The format used for configuring File Register/Extension File Register points remains the same: **R**x, where x = address offset.

Unsolicited Data

Unsolicited data is supported for this communication interface. Ladder logic must be developed to support the communications. Be sure that the unsolicited data is transmitted at a reasonable rate to the CIMPLICITY HMI host computer. The ladder logic should also check to ensure that the connection has been made *and* that the requests are acknowledged.

Examples of ladder logic are provided in the Mitsubishi Melsec P.L.C. documentation.

The format of the unsolicited data message is:

```
Number of words in the message
Offset address
Data value
Offset address
Data value
   .
   .
   .
```

The communication enabler automatically assumes that the Fixed Buffer data is to be updated.

Consider the following example:

```
4
0x500
0x10
0x501
0x20
```

Any point with a point address of U0500 whose point size was less than or equal to 2 bytes is updated to a value based on 0x10. For example, an ANALOG_16 point at U0500 would be 0x10.

Any point with a point address of U0501 is also be updated as long as the point size is less than or equal to 2 bytes. The points are updated based on U0501 having a value of 0x20.

Advanced Configuration Requirements

Changing Timing and Performance Characteristics

You can adjust the timing and performance characteristics of the MITSUBISHI TCP/IP communications by changing or defining the logical names listed below.

These logical names are defined in the CIMPLICITY HMI logical names file. This file is located in your project's **\data** directory and is named **log_names.cfg**. *For detailed information on editing this file and the format used by its records, see "System Management" in the CIMPLICITY HMI Base System User's Manual (GFK-1180).*

DCQ_DEAD_TIME

When Mitsubishi TCP/IP communications writes an asynchronous request via a socket to the P.L.C., and the request remains outstanding for more than 120 seconds, the device is declared "dead".

To change the time-out, add the following record to the **log_names.cfg** file:

```
DCQ_DEAD_TIME|P|default|10|<seconds>
```

where **<seconds>** is the number of seconds to wait before declaring the device "dead".

You can disable this feature by using **-1** for **<seconds>**.

DC_TCP_POLL_MS

When Mitsubishi TCP/IP communications polls a socket for input, it uses a polling interval of 10 milliseconds. If you see a large number of Ethernet error messages in the *Status Log*, consider increasing this value.

To increase the polling interval, add the following record to the **log_names.cfg** file:

```
DCQ_DEAD_TIME|P|default|10|<milliseconds>
```

where **<milliseconds>** is the number of milliseconds in the polling interval. Enter a number greater than 10.

DC_CONNECT_URETRY_CNT

After Mitsubishi TCP/IP communications declares a device "dead", it periodically tries to re-establish communications between poll checks. The default number of tries is 10.

To change the number of retries, add the following record to the **log_names.cfg** file:

```
DCQ_CONNECT_URETRY_CNT|P|default|10|<retries>
```

where **<retries>** is the number of retries to re-establish communications between poll checks. You should know that:

- Larger values will tend to increase the amount of time it takes to recognize that a device has recovered and re-establish the connection.
- Smaller values will increase the overhead if there are a number of devices down.

DC_CONNECT_MS

Once Mitsubishi TCP/IP communications initiates a request to a device, it waits 100 milliseconds for the connection to be established. If the connection is not established at the end of this time interval, the connect request times out.

To change this connect request interval, add the following record to the **log_names.cfg** file:

```
DCQ_CONNECT_MS|P|default|10|<milliseconds>
```

where **<milliseconds>** is the number of milliseconds to wait for a connection to be established. between poll checks. You should know that:

- If the value is too small, the Mitsubishi TCP/IP communications will fail to establish a connection to the device.
- A larger value will tend to impact the performance of Mitsubishi TCP/IP communications in a way directly proportional to the number of down devices and the frequency of retries.

MSYNC_TICKS and MMAX_SYNC_TICKS

Service requests such as read point, setpoint, read address and write address as well as point initialization are performed synchronously. The default behavior is to use the defined maximum asynchronous age request. This value is defined by the logical DCQ_DEAD_TIME (the units are automatically converted to ticks to ensure equivalence). If no value is defined, the default value is 2 minutes.

These logical names are equivalent, with MSYNC_TICKS taking precedence. This logical controls how long (in ticks) Mitsubushi TCP/IP communications will wait for a synchronous response from a device, once the request has been made of the device.

To change these time-outs, add the following records to the **log_names.cfg** file:

```
MSYNC_TICKS|P|default|10|<milliseconds>
MMAX_SYNC_TICKS|P|default|10|<milliseconds>
```

where **<milliseconds>** is the number of milliseconds.

Matching Addresses with Unsolicited Messages

The following logical names control how addresses are matched with unsolicited messages. By default, Mitsubishi TCP/IP communications matches each register address with either the HEX or DECIMAL addresses or both.

- If either **<prcnam>_UNSO_HEX** or **<prcnam>_UNSO_DEC** is defined to be TRUE, addresses are matched using only the defined method.
- If **<prcnam>_UNSO_ALL_TYPES** is defined to be true, Mitsubishi TCP/IP communications matches the address with both the HEX and DECIMAL addresses.
- If more than one method is defined, the default behavior will take precedence.

The value of **<prcnam>** is **MTCPIP0** in a standard configuration.

The default method is **<prcnam>_UNSO_EITHER**.

<prcnam>_UNSO_HEX

The format for this record in the **log_names.cfg** file is:

<prcnam>_UNSO_HEX|P|default|10|<value>

where **<prcnam>** is the Mitsubishi TCP/IP communications process name and **<value>** is TRUE or FALSE.

When this logical name is set to TRUE, unsolicited point addresses are matched to their Hexadecimal format addresses.

<prcnam>_UNSO_DEC

The format for this record in the **log_names.cfg** file is:

<prcnam>_UNSO_DEC|P|default|10|<value>

where **<prcnam>** is the Mitsubishi TCP/IP communications process name and **<value>** is TRUE or FALSE.

When this logical name is set to TRUE, unsolicited point addresses are matched to their Decimal format addresses.

<prcnam>_UNSO_ALL_TYPES

The format for this record in the **log_names.cfg** file is:

<prcnam>_UNSO_ALL_TYPES|P|default|10|<value>

where **<prcnam>** is the Mitsubishi TCP/IP communications process name and **<value>** is TRUE or FALSE.

When this logical name is set to TRUE, unsolicited point addresses are matched to *both* their Hexadecimal and Decimal format addresses.

<PRCNAM>_UNSO_EITHER

The format for this record in the **log_names.cfg** file is:

<prcnam>_UNSO_EITHER|P|default|10|<value>

where **<prcnam>** is the Mitsubishi TCP/IP communications process name and **<value>** is TRUE or FALSE.

When this logical name is set to TRUE, unsolicited point addresses are matched to *either* their Hexadecimal or Decimal format addresses or both.

This is the default method.

Mitsubishi TCP/IP Troubleshooting

The CIMPLICITY *Status Log* often provides helpful hints on communication problems that you might encounter, especially during initial configuration.

The following message indicates that the Scan Rate you selected faster than the data can be collected. This is not an error.

Skipping polling around <POINT ID> because request is already pending.

The following messages often indicate one or more configuration errors.

Other error messages can appear in the CIMPLICITY HMI *Status Log*. Please check the CIMPLICITY HMI *Status Log first* if you encounter problems with your device communications. If you need help interpreting the messages in the CIMPLICITY HMI *Status Log*, please contact the CIMPLICITY Technical Support Hotline.

Gethostname failed

If the PLC name and socket port number entered in the *Melsec* property page are not configured in your host file, the following message will appear in the log file:

Gethostname for <hostname> failed - errno <number>

To resolve this problem, configure the host name into your computer system as described in step 5 of the Melsec PLC Communications Configuration Checklist. Remember that the names or aliases must match exactly.

Unable to get a socket

If you do not have enough sockets in your system, the following will appear:

Unable to get a socket - errno = <number>

Contact your system administrator for help in tuning the operating system.

Bind for port failed

If you have not properly configured the socket port number within your CIMPLICITY application with that configured on the PLC, you will get the following error message:

Bind() for <hostname> port <port number> failed - REFUSED

You may also get this message at startup if another application is using your port *or* the socket has not cleared from a previous use. You may also get this message if your CIMPLICITY configuration for the device is inconsistent between your computer and the programmable controller.

To determine if the socket is in use, type the following command:

netstat

and look for the line showing your configured **<Host name>:<Port number>** combination under the "Foreign Address". If the last column says "TIME_WAIT", this means that the connection was previously in use and is in the process of cleaning up. No further action is needed.

If the last column says "ESTABLISHED", this means that the socket port is in use. Check to make sure that you do have a connection (you can usually tell by examining the leds on your programmable controller's Ethernet card). If you do not have a connection, contact your system administrator for assistance in locating the application using the port.

If the command yields no information, this usually indicates that the IP address or socket port number configured on the computer does not match the configuration in the programmable controller. Review the configuration on both the computer and programmable controller and correct the mismatch.

Modbus Plus Communications

About Modbus Plus

The CIMPLICITY Modbus Plus Device Communication enabler has been enhanced to support up to 4 SA85 Interface cards.

SA85-000	standard single port Modbus Plus card
SA85-002	redundant, dual port Modbus Plus card
SM85-000	Micro-channel version of the SA85 card
AT98	Programmable controller on a board which uses remote I/O for control

In this document, all references to an SA85 card refer to the any of the above cards.

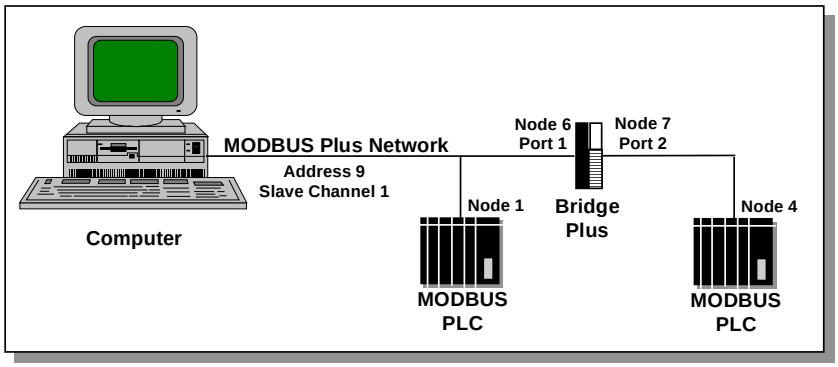
This enabler supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Unsolicited data
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Sample Modbus Plus Network



Supported Modbus Plus Devices

The Modbus Plus communications enabler supports Modicon 984 series programmable controllers. The following types of data collection are supported:

Solicited Data Devices may be accessed directly from a Modbus Plus network, Bridge Plus bridge or Bridge Multiplexor.

Unsolicited Data Unsolicited data collection is supported for devices connected directly to Modbus Plus or via a Bridge Plus bridge.

Supported Modbus Plus Memory Types

Data may be read from the following memory types:

Coils

Discrete Inputs

Input Registers

Holding Registers

General Reference

Holding Registers as Double Precision

Data may be written to the following memory types:

Coils

Holding Registers

General Reference

Holding Registers as Double Precision

Double Precision Notes

D4xxxx(x) points are Holding Register Points interpreted as Double Precision. Two registers are used for each point with both registers are assumed to have a positive value.

Because of this mapping:

- Do not declare Double Precision points with overlapping addresses. For example, D40001 and D40002 overlap, while D40001 and D40003 do not.
- Do not define points that use the same Holding Register and Double Precision point address (for example, defining one point with the address D40001 and another with the address 40001).

Configure Double Precision points as **DINT** or **UDINT** point.

Arrays are not supported for Double Precision points.

Modbus Plus Required Documents

You should have the following document available when configuring Modbus Plus device communications:

Modicon IBM Host Based Devices User's Guide **(GM-HBDS-001)**

In addition, if you are planning to send unsolicited data from a Modbus Plus controller, you should have the following document available:

Modicon 984 Programmable Controller Systems Manual **(GM-0984-SYS)**

Modbus Plus Installation Checklist

Prior to going through this checklist, install the CIMPLICITY HMI base system software and the Modbus Plus communications enabler product option.

Note

Under some circumstances, the Modbus Plus communications protocol cannot be reliably used in systems that use external caching hardware. If your computer uses external memory caching, you must be able to exclude the shared memory addresses used by your SA85 cards. The device communications protocol and test program may fail to operate correctly if this is not done.

1. Determine the following information for the SA85 card:

   - A *unique* Interrupt (IRQ)
   - A *unique* Shared Memory Address Range
   - A *unique* Modbus Plus Address

   The IRQ and the shared memory used by the card must be unique among all hardware installed in the computer.

   Configuring an interrupt is *required*. The default switch settings of the SA85 card have the interrupt disabled. Be sure to check this before installing the card into your computer.

   The Modbus Plus address must be unique to your Modbus Plus network.

2. Set the jumpers and switches on the card to correspond to the IRQ and addresses you have chosen.
3. Install the card in your computer.
4. Use the *SA85 Card Configuration* function to inform the driver of the IRQ, Start Shared Memory address and the Modbus Plus address you have chosen.
5. Use the *Modbus Plus Diagnostics* function to verify the SA85 card configuration and to test communications with programmable controllers on the network.
6. Use the *Ports* function to create port information for each SA85 card.
7. Use the *Devices* function to configure one CIMPLICITY device for each programmable controller from which data will be collected.
8. Use the *Device Points* function to configure points for the devices on the Modbus Plus network.

The Interrupt (IRQ) must be configured. The SA85 driver is written to operate in an interrupt driven mode. This permits multiple applications to communicate asynchronously with multiple programmable controllers in the most efficient manner possible. The SA85 card used in the development of this driver had several labeled jumpers along the left end of the board identified by ISR numbers 3 - 7 and 'A' for polled operation. The jumper should *not* be on the 'A' factory default setting for this Windows NT driver. The Modicon documentation only lists these interrupt jumpers as "Reserved," and Modicon driver software only supports polled operation of the card.

Special Note on I/O Cards

Problems have been reported following installation of some communication cards into some 486 and Pentium computers and other computers equipped with PCI and ISA interface bus slots. The Modicon SA85 Modbus Plus card, and many Ethernet interface cards use memory mapped I/O, which by default is often not available in PCI/ISA bus computers.

Symptoms of this problem are seen when a driver attempts to access the I/O space of the card and all the driver sees is a mirror of the system main memory. This problem can become even more confusing when reads from the card I/O work, but I/O writes fail to produce the intended results.

Basically, the PCI/ISA controller maps computer system memory over the ISA memory address space. The BIOS setup usually has allocation features to allow access of memory mapped I/O and interrupts.

Different computers and BIOS setups use different terms to describe the memory mapping. Often memory mapped I/O is referred to as "Shared Memory" (not to be confused with inter-program shared memory on UNIX machines).

From within the computer BIOS setup, look for terms such as PCI Configuration, or ISA Bus Setup. Typically, a memory configuration menu will allow a block of memory, such as 64 KB starting at address D000:0000, to be selected. Simply configure the ISA bus cards and drivers to use memory within the configured window.

For example, on the Gateway P60 system, an ISA Shared Memory block may be enabled. The menu choice starts the address space at C8000, and a single range of 32 KB, 64 KB, or 96 KB may be selected. To install a 16 KB memory mapped Ethernet card, select the 64 KB range and place the Ethernet card at address D0000. Addresses C8000-CFFFF and D4000-D7FFF will still be available.

Special Note on General Reference Registers

If you have PLCs in your configuration that do not contain General Reference registers, the *Modbus Plus Diagnostics* program will run correctly. However, the Modbus Plus Communications enabler, by default, attempts to validate the General Reference registers on all devices when it initializes. You can change this behavior with global parameters *(see "Supporting PLCs without General Reference Registers" on page 14-36).*

Configuring the SA85 Card

For the SA85 Card Configuration program to run successfully, you must have successfully installed CIMPLICITY HMI software's Modbus Plus communication enabler, and configured up to four SA85 cards. Configuration of the SA85 Driver is maintained within the Windows NT registry. The *SA85 Card Configuration* utility edits this registry during installation.

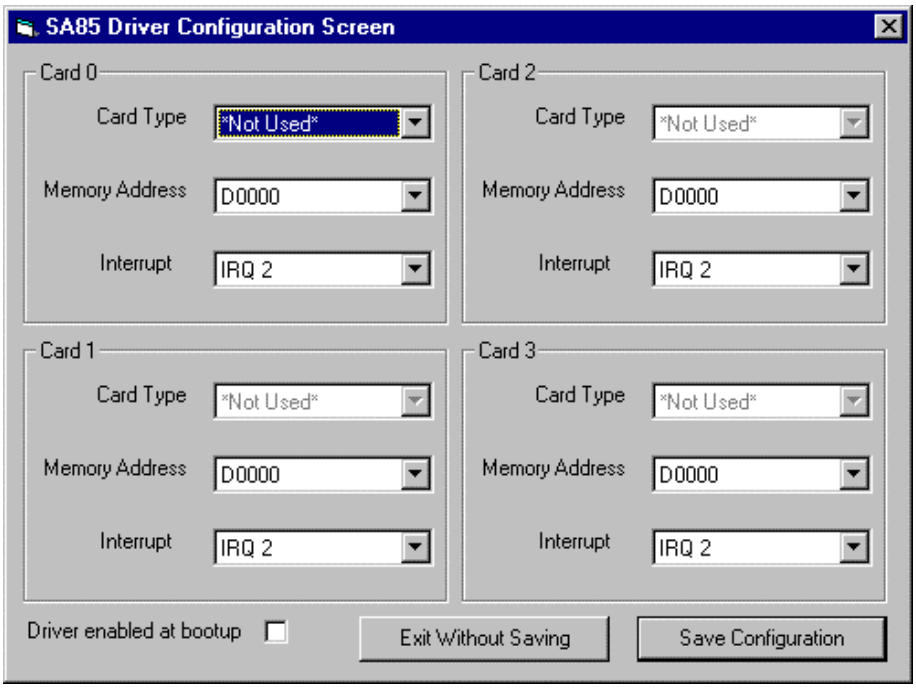
If multiple cards are required, it is up to the user to insure that all SA85 cards installed in the CIMPLICITY NT workstation have a unique interrupt and I/O address. Once the cards are installed, run the new configuration utility (SA85CONF). Enter the appropriate information for each SA85 card. Click the 'Save Changes and Exit' button. Then restart the computer.

Within the CIMPLICITY project, you should create one CIMPLICITY Port for each SA85 card installed in the workstation. The Ports will be named MASTER_MBP00 through MASTER_MBP03. You then configure the CIMPLICITY Devices on each SA85 card's 'Port' as usual.

SA85 Card Configuration

To start the card configuration program, select the *SA85 Card Configuration* icon in the CIMPLICITY HMI menu.

The *SA85 Driver for Windows Setup* dialog box opens.



You must configure the following information for the SA85 card(s) that you have installed:

Memory Address	Enter a unique starting memory address in shared memory on your PC for the SA85 card.
Interrupt	Enter the interrupt (IRQ) to be used for the SA85 card.
Card Type	Select the SA85 card type. The valid choices are: **SA85-000** **SM85-000** **SA85-002** **AT984**

Select **Save Configuration** to save your configuration changes, or select **Exit Without Saving** to exit the utility without saving any changes.

After you save the changes, the registry enables the port you configured at bootup.

To verify that the SA85 card is operating correctly, use the *Modbus Plus Diagnostics* utility.

Modbus Plus Installation Verification

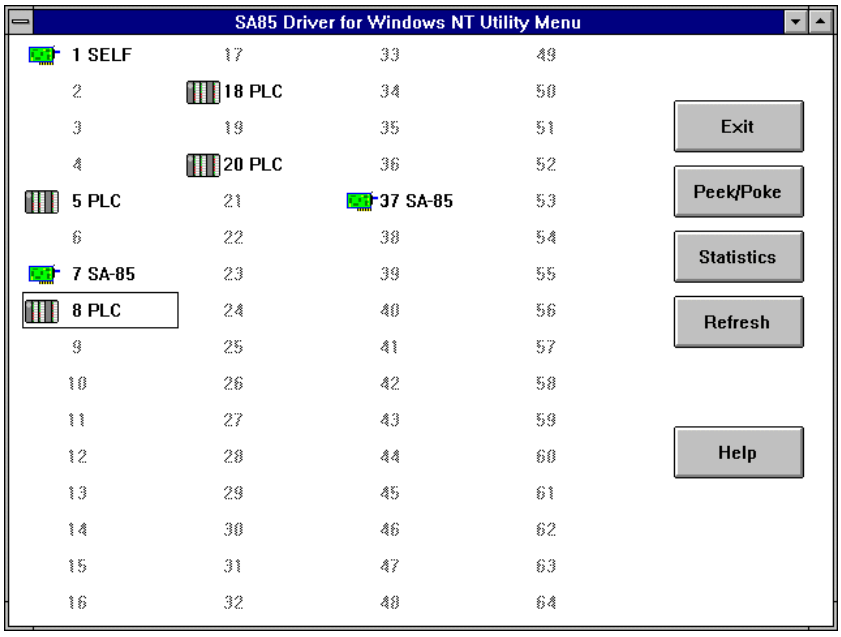
You can use the Modbus Plus Diagnostics program provided with the CIMPLICITY HMI Modbus Plus communication enabler to check the basic configuration and operation of your network without starting a CIMPLICITY HMI project. You can perform the following functions:

- Updates of the currently displayed file type
- Read test
- Write test

For this program to function, you must have successfully installed the CIMPLICITY HMI Modbus Plus communication enabler, and configured the SA85 port and devices using CIMPLICITY HMI application configuration functions.

To start the program, select the *Modbus Plus Diagnostics* icon in the CIMPLICITY HMI menu.

The *SA85 Driver for Windows NT Utility Menu* window opens.



This menu monitors data communications and displays the active nodes on the network. Each active node address has an icon displayed next to it that indicates whether the device is a programmable controller or communications card. If communications to a node are lost, the icon is displayed dim and cannot be selected.

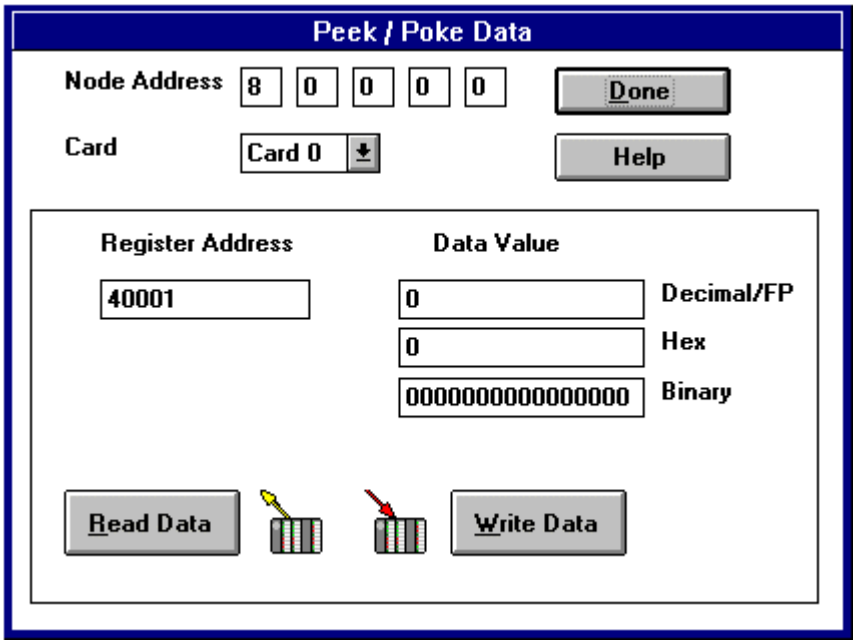
To read or write test data to a programmable controller:

1. Select a programmable controller from the screen.
2. Select **Peek/Poke**.

To display communication statistics, select **Statistics**.

Reading and Writing Modbus Plus Test Data

When you select **Peek/Poke**, the *Peek/Poke Data* dialog box opens.



The node address and SA85 card used by the programmable controller are displayed at the top of the screen.

To read data:

1. Enter a valid address in the **Register Address** field.
2. Select **Read Data**.

The current contents of the address are displayed in the **Data Value** fields in decimal, hexadecimal, and binary format.

To write data:

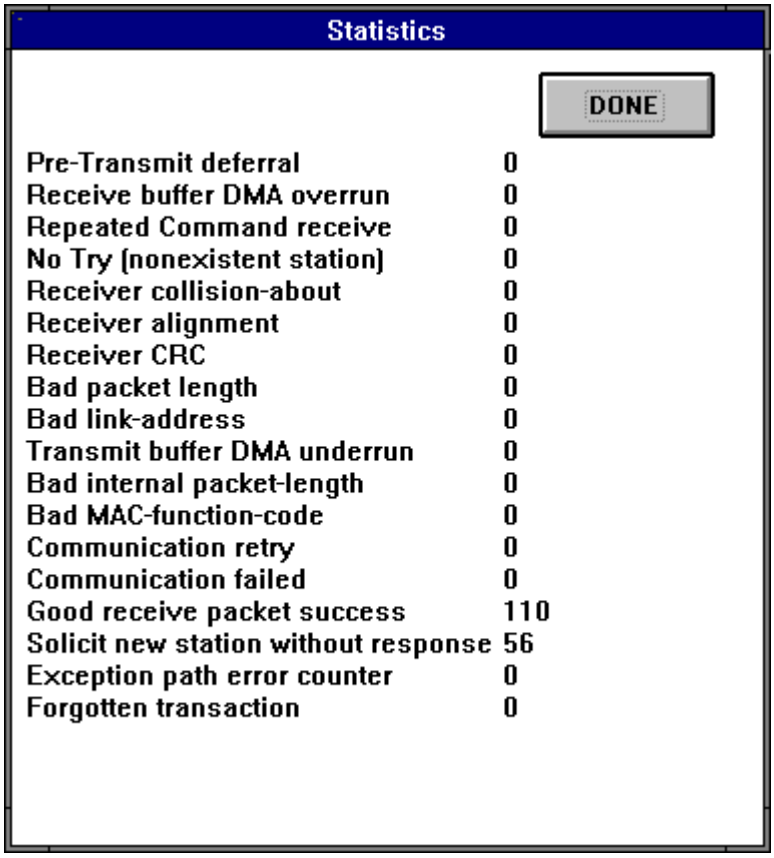
1. Enter a valid address in the **Register Address** field.
2. Enter a valid data value in one of the **Data Value** fields.
3. Select **Write Data**.

To select another programmable controller for testing, enter its node number in the **Node Address** field.

To exit back to the *SA85 Driver for Windows NT Utility Menu*, select **Done**.

Displaying Modbus Plus Network Statistics

When you select **Statistics**, the *Statistics* window opens.



This window displays the current network statistics for the Modbus Plus network serviced by the SA85 card.

To exit back to the *SA85 Driver for Windows NT Utility Menu*, select **Done**.

Modbus Plus Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to Modbus Plus communications.

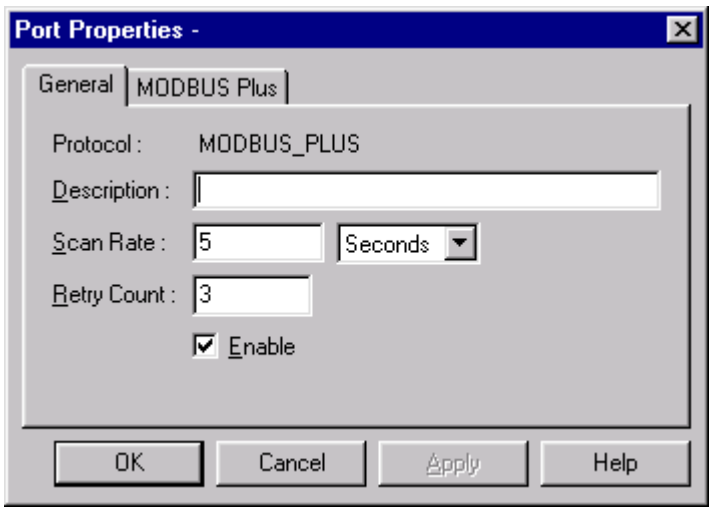
Modbus Plus Port Configuration

When you create a new port for Modbus Plus communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **MODBUS_PLUS** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for Modbus Plus communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

Modbus Plus General Port Properties



Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

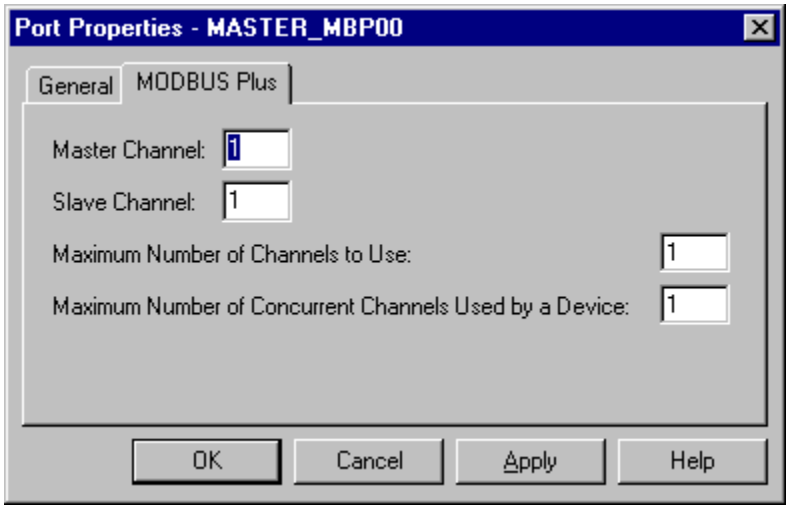
Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.
Retry Count	If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it. Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Modbus Plus Port Properties

The Modbus Plus Devcom supports communication across a Modbus Plus network via a SA-85 card mounted within the CIMPLICITY workstation. The SA-85 card supports eight Data Master channels, each of which can communicate with a Modbus Plus device asynchronously. Until now, the CIMPLICITY Modbus Plus Devcom supported synchronous communication using only one of these channels.

It is possible to select the number of channels the Devcom will use for communicating with Modbus Plus devices. This is accomplished through two settings found on the Modbus Plus tab of the Port Properties dialog box in the CIMPLICITY Configuration Manager. This dialog box looks like this:



Use the Modbus Plus tab in the Port Properties dialog box to enter specific information for the port. You can define the following:

Master Channel Enter the channel number of the SA85 card.

Slave Channel Enter the channel number (1-8) on the card used to receive unsolicited data.

Note

Programmable controllers sending unsolicited data to CIMPLICITY HMI software can send it to this port using an address of **`<Modbus_Plus_address>.<slave_channel>.0.0.0`**

Maximum Number of Channels

The allowed values to use are [1] through [8]. If a value less than [1] is entered, then [1] is used. If a number greater than [8] is entered, then [8] is used. A value of [1] will cause the Modbus Plus Devcom to operate exactly as it always has in past releases. Synchronous communication will be performed through a single channel on the SA-85 card.

If a value greater than [1] is entered, then the Devcom will use asynchronous communication across the number of channels you specify, up to the [8] available channels.

Maximum Number of Concurrent Channels

The Maximum Number of Concurrent Channels Used by a Device setting may contain a value no less than [1], and no greater than the value specified for Maximum Number of Channels to Use, MINUS ONE. This setting is ignored if only [1] channel is used. In general, this setting should be one less than the Maximum Number of Channels to Use.

If your project configuration specifies more than one Modbus Plus Device, and the number of points configured on one device is much greater than on the other(s), or if one device is significantly slower than the other(s), a situation may arise where this device is 'tying up' all of the channels you are using, and the other device(s) are not getting updated. If you determine that this may be the case, then lower the Maximum Number of Concurrent Channels Used by a Device to some value (lets call it [X]).

What you are telling CIMPLICITY is this:

If all of the channels are busy requesting data, make sure that any ONE device is only using [X] of those channels. This means that the remaining channels are kept free for other devices, and no device can tie up all of the channels.

Whether or not you should use more than one channel depends upon you hardware and project configuration. It is important to remember that as the number of channels used increases, so does the number of CPU cycles needed by CIMPLICITY. How many points are configured, and how often you require their values to be updated plays a major role in the decision to use multiple channels. If you have only a few points or the points you have only update every few seconds, then using multiple channels will probably not affect the overall performance. If you have many points, which require fast updates, and the scan rate you are asking for is not being met, then using multiple channels may help

Modbus Plus Device Configuration

When you create a new device for Modbus Plus communications, enter the following information in the *New Device* dialog box:

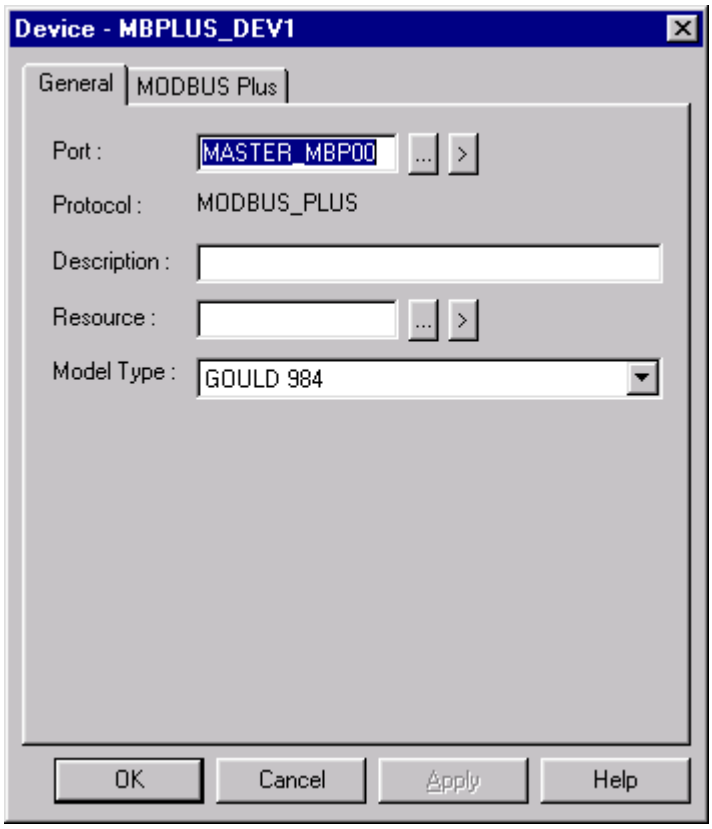
1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Modbus Plus port to be used by the device.

When you select **OK** to create the device, the *Device Properties* dialog box opens.

Important

Only one CIMPLICITY HMI device can be configured per physical Modicon programmable controller. Modbus Plus communications will not run with multiple CIMPLICITY HMI devices configured for the same programmable controller.

Modbus Plus General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - ... - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - > - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

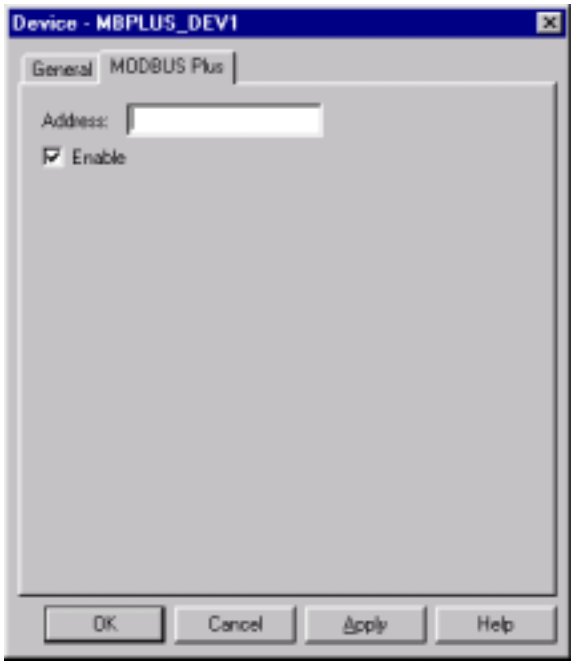
Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button - ... - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - > - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the only choice is:

GOULD 984

Modbus Plus Device Properties



Use the Modbus Plus tab in the Device dialog box to enter information about Modbus Plus communications for the device. You can define the following:

Address Enter the unique Modbus Plus address for the device.

Any CIMPLICITY HMI devices that use the same Modbus Plus address should not be enabled at the same time.

For a local node, the polling address is the node number of the programmable controller.

For remote communications through a bridge, this is an address consisting of up to five fields. When the CIMPLICITY HMI computer is controlling communications over a bridge, the polling address format is:

<bridge_port_1_no>.<PLC_no>

For unsolicited messages from a local node, the unsolicited address format is:

<Modbus_Plus_address>.<slave_channel_no>

For unsolicited messages through a bridge, the unsolicited address format is:

<bridge_port_2_no>.<Modbus_Plus_address>.<slave_channel_no>

In addition, each unsolicited message must include the polling address.

Enable Set this check box to enable the device when the project starts. If you clear this check box, the device will not be enabled and points associated with the device will be unavailable.

Sample Modbus Plus Device Configuration

For example, in our sample Modbus Plus network configuration from the first page of this section:

- The polling address for the first programmable controller is "1".
- The polling address for the second programmable controller is "6.4".
- The unsolicited address for messages being sent from the first programmable controller to the PC is "9.1". Such message must include the polling address "1".
- The unsolicited address for messages being sent from the second programmable controller to the PC is "7.9.1". Such messages must include the polling address "6.4".

Modbus Plus Point Configuration

Once your devices are configured, you may configure points for them. Through device point configuration, you may configure the following:

- Points that read or set Coils.
- Points that read Discrete Inputs.
- Points that read Input Registers.
- Points that read or set Holding Registers.
- Points that read or set General Reference
- Points that read Holding Registers as Double Registers

The fields described below have configuration values that are unique to or have special meaning for Modbus Plus communications.

Modbus Plus General Point Properties

On the General tab in the Point Properties dialog box, the type of **Access** you choose depends on the point address:

- Select **Read** for points from Discrete Inputs or Input Registers.
- Select **Read/Write** for points from Coils, Holding Registers, General Reference or Double Precision.

Modbus Plus Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria

The update criteria determines how the data will be requested.

Select **On Change** or **On Scan** for points whose value should be polled by the Modbus Plus driver at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by the Modbus Plus driver at regular intervals while users are viewing them.

Select **Unsolicited** for points whose value will be sent by the programmable controller as necessary.

Important

It is absolutely necessary that the address of the unsolicited data exactly match the point address.

Address

Enter the point address of the data as follows:

`0xxxx` or **`0xxxxx`** for Coils

`1xxxx` or **`1xxxxx`** for Discrete Inputs

`3xxxx` or **`3xxxxx`** for Input Registers

`4xxxx` or **`4xxxxx`** for Holding Registers

`6yxxxx` or **`6yxxxxx`** for General Reference

`D4xxxx` or **`D4xxxxx`** for Holding Registers as Double Precision

where **`xxxx`** or **`xxxxx`** is the bit number or register number of the point. For example, the address of Holding Register one would be 40001, and the address of Coil one would be 00001.

If you are configuring a General Reference point, **`y`** is the file number.

Double Precision points in Holding Registers require two Holding Registers per point. The upper register is multiplied by 10000 and the product is added to the lower register to get the resulting value. No more than one Double Precision point may be written in a single write operation. Use **DINT** or **UDINT** types for these points.

If you are configuring an Analog point type in Discrete Inputs or Coils, the address entered in this field must be that of the least significant bit of the point. For example, if you configure 16-bit analog point for Coils 17 through 32, enter 00017 in this field.

When you configure Boolean points in Holding Registers, Input Registers or General Reference, you must also enter data in the following field:

Bit Offset Enter the bit offset in the Holding Register or Input Register or General Reference that defines the point, where 0 is the least significant bit and 15 is the most significant bit.

Modbus Plus Unsolicited Data

To send unsolicited point values from a Modbus Plus programmable controller to the CIMPLICITY HMI Modbus Plus communication enabler, a 984 MSTR function block must be coded in the ladder logic. The MSTR block can send a request to write to holding registers in another Modbus Plus slave. The Modbus Plus communication enabler uses the data portion of this message to hold a command to set a CIMPLICITY HMI point value. The data portion of the MSTR block can also include time-stamping data.

The total transfer size for a command is 100 words (200 bytes). The size of the point data in the command depends on the time-stamp format for the data:

No time stamping	95 words
Compressed time stamping	92 words
Uncompressed time stamping	87 words

It is up to the user to put the time-stamp data in the correct format in the PLC. If the PLC sends an invalid time-stamp, the Modbus Plus communications enabler writes an error message to its standard error file (mbp00.err) and time-stamps the data with the computer's time. Invalid dates include dates before January 1, 1970 and years greater than 9999.

The Modbus Plus communications enabler can receive unsolicited values for points in all four device memory types (Coils, Discrete Inputs, Input Registers, and Holding Registers) and from programmable controllers over the Modicon Bridge Plus.

CIMPLICITY HMI device points whose addresses exactly match the address in [Word 3] of the command, whose length is less than or equal to the number of data bytes sent (as specified in [Word 4] of the command), and that are configured on a device whose Modbus Plus address matches that of the device sending the command will be updated with values from the command.

Important

The addresses must be in Hex format when going through a Bridge Plus for unsolicited data with Modbus Plus.

Note

You can find information on ladder logic programming and the MSTR block function in the Modicon 984 Programmable Controller Systems Manual (GM-0984-SYS).

MSTR Block Data Area Format

Word 0 Network address of the sending programmable controller in hexadecimal notation. This must match the network address configured in Device Configuration. For example:

Network address = 1

Word 0 = 1

Word 1 = 0

Word 2 = 0

Network address = 6.4

Word 0 = 0406

Word 1 = 0

Word 2 = 0

Word 1 Zero

Word 2 Zero

Word 3 Address of the point to be updated. Valid values are:

1 - 8192 for Coils

10001 - 18192 for Discrete Inputs

3001 - 39999 for Input Registers

4001 - 49999 for Holding Registers

Word 4 Number of bytes of point data being sent. Valid values are:

1-190 for no time-stamping

1-184 for compressed time stamping

1-174 for uncompressed time stamping

If the most significant bit of this word is set, the Modbus Plus communications enabler assumes that the unsolicited data is time-stamped.

Word 5

through

Word 99 These words contain the following: No time-stamping - Words 5 through 99 contain 95 words of point data.Compressed time-stamping - Words 5 through 7 contain the time-stamp and Words 8 through 99 contain point data.Uncompressed time-stamping - Words 5 through 12 contain the time-stamp and Words 13 through 99 contain point data.

Uncompressed Time-Stamp Format

For the uncompressed time-stamp, Words 5 through 12 contain the following information:

Word 5 The 16 bits of this word are formatted as follows:

FFFnnnnnnnnnnnn

where:

FFF = 000

nnnnnnnnnnnn = is meaningless and ignored

Word 6 The month of the year (1-12)

Word 7 The day of the month (1-31)

Word 8 The year (0-4095)

Word 9 The hour (0-23)

Word 10 The minutes after the hour (0-59)

Word 11 The seconds after the minute (0-59)

Word 12 The ticks after the second (0-99) where 100 ticks = 1 second

Compressed Time-Stamp Format

For the compressed time-stamp, Words 5 through 7 contain the following information:

Word 5 The 16 bits of this word are formatted as follows:

FFFSSSSSSTTTTTTT

where:

FFF = 001

SSSSSS = the number of seconds (0-59)

TTTTTTT = the number of ticks after the second (0-99)

(where 100 ticks = 1 second)

Word 6 The 16 bits of this word are formatted as follows:

DDDDDHHHHHMMMMMM

where:

DDDDD = the day of the month (1-31)

HHHHH = the hour of the day (0-23)

MMMMMM = the minutes after the hour (0-59)

Word 7 The 16 bits of this word are formatted as follows:

MMMYYYYYYYYYYY

Where

:MMMM = the month of the year (1-12)

YYYYYYYYYYYY = the year (0-4095)

Compressed Time-Stamp with mSecs Format

For the compressed time-stamp, Words 5 through 8 contain the following information:

Word 5 The 16 bits of this word are formatted as follows:

FFFnnnnnnnnnnnn

where:

FFF = 010

nnnnnnnnnnnn = is meaningless and ignored

Word 6 The seconds and ticks with msecs can be formatted as follows.

SSSSSSTTTTTTTTT

where:

SSSSSS = the number of seconds (0-59)

TTTTTTTTTT = the number of mSecs after the second (0-999) (where 1000 mSecs = 1 second)

Word 7 The 16 bits of this word are formatted as follows:

DDDDDHHHHHMMMMMM

where:

DDDDD = the day of the month (1-31)

HHHHH = the hour of the day (0-23)

MMMMMM = the minutes after the hour (0-59)

Word 8 The 16 bits of this word are formatted as follows:

MMMYYYYYYYYYYY

Where

:MMMM = the month of the year (1-12)

YYYYYYYYYYYY = the year (0-4095)

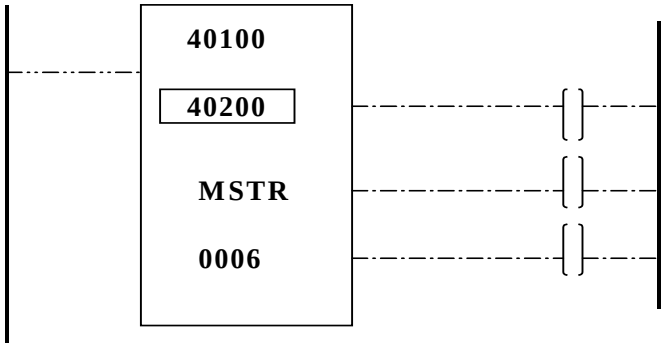
Uncompressed Time-Stamp with mSecs Format

For the uncompressed time-stamp, Words 5 through 12 contain the following information:

Word 5	The 16 bits of this word are formatted as follows: FFFnnnnnnnnnnnn where: FFF = 011 nnnnnnnnnnnn = is meaningless and ignored
Word 6	The month of the year (1-12)
Word 7	The day of the month (1-31)
Word 8	The year (0-4095)
Word 9	The hour (0-23)
Word 10	The minutes after the hour (0-59)
Word 11	The seconds after the minute (0-59)
Word 12	The mSecs after the second (0-999 where 1000 mSecs = 1 second

Sample MSTR Block -No Timestamping

The diagram below summarizes the use of the MSTR block to send unsolicited data without timestamping to the CIMPLICITY HMI Modbus Plus communication enabler from a device.



In this example:

- The Control Block, found in Holding Registers 40100 through 40108, contains control information for the MSTR block. These indicate that six registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001.

- The CIMPLICITY HMI Modbus Plus Device Communications Enabler does not use address information configured in the control block. Instead, it interprets the data area as a command.

- The Data Block, found in Holding Registers 40200 through 40205, contains a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035.

Control Block without Timestamping

The Control Block used to send the sample data is stored in Holding Registers 40100 through 40108. Values stored in the Control block are:

	Register	Local Example	Bridge Example	
Write Command	40100	1	1	
Status Word	40101	xxxxx	xxxxx	
Number of registers to send	40102	6	6	
Destination HR in Slave device	40103	40001	40001	
SA85 Modbus Plus address (1-64)	40104	9	7	*
SA85 Slave channel (1-8)	40105	1	9	**
Routing Parameter	40106	0	1	***
Routing Parameter	40107	0	0	
Routing Parameter	40108	0	0	

* Bridge address
** Modbus Plus address of SA85
*** Slave channel

These Holding Registers indicate that six registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001

Data Area with no Timestamping

The Data Area used to send the sample data is stored in Holding Registers 40200 through 40205. The sample data being sent is:

	Register	Local Example	Bridge Example
Network address of sending PLC	40200	1	0406
	40201	0	0
	40202	0	0
Address of point receiving unsolicited data	40203	30017	30017
Number of bytes of data	40204	2	2
The unsolicited value	40205	21035	21035

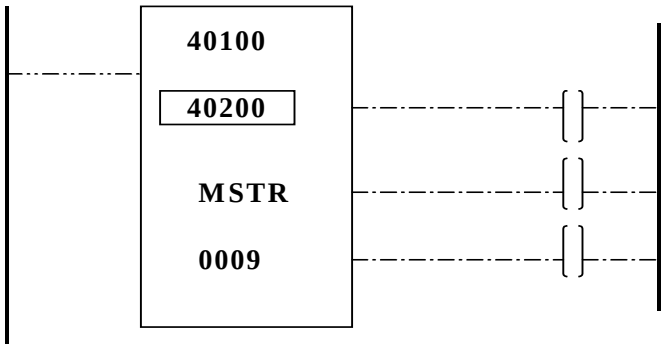
Holding Registers 40203 through 40205 contain a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035.

The network address of the sending programmable controller is the Modbus Plus Routing Path from the SA85 back to the sending controller.

- For local data, the path is only 1 address long and the sending controller's Modbus Plus address is put into the lower byte of the first holding register. The other two holding registers are set to zero.
- For bridged data, the path may be 5 addresses long. The example above shows the path 6.4.0.0.0.

Sample MSTR Block - Compressed Timestamping

The diagram below summarizes the use of the MSTR block to send unsolicited data with compressed timestamping to the CIMPLICITY HMI Modbus Plus communication enabler from a device.



In this example:

- The Control Block, found in Holding Registers 40100 through 40108, contains control information for the MSTR block. These indicate that nine registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001.
- The CIMPLICITY HMI Modbus Plus Device Communications Enabler does not use address information configured in the control block. Instead, it interprets the data area as a command.
- The Data Block, found in Holding Registers 40200 through 40208, contains a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035 with a compressed timestamp.

Control Block with Compressed Timestamping

	Register	Local Example	Bridge Example	
Write Command	40100	1	1	
Status Word	40101	xxxxx	xxxxx	
Number of registers to send	40102	9	9	
Destination HR in Slave device	40103	40001	40001	
SA85 Modbus Plus address (1-64)	40104	9	7	*
SA85 Slave channel (1-8)	40105	1	9	**
Routing Parameter	40106	0	1	***
Routing Parameter	40107	0	0	
Routing Parameter	40108	0	0	

* Bridge address
** Modbus Plus address of SA85
*** Slave channel

These Holding Registers indicate that nine registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001

Data Area with Compressed Timestamping

The Data Area used to send the sample data with compressed timestamping is stored in Holding Registers 40200 through 40208. The sample data being sent is:

	Register	Local Example	Bridge Example
Network address of sending PLC	40200	1	0406
	40201	0	0
	40202	0	0
Address of point receiving unsolicited data	40203	30017	30017
Number of bytes of data.	40204	32770	32770
First timestamp word	40205	9442	9442
Second timestamp word	40206	29419	29419
Third timestamp word	40207	22477	22477
The unsolicited value	40208	21035	21035

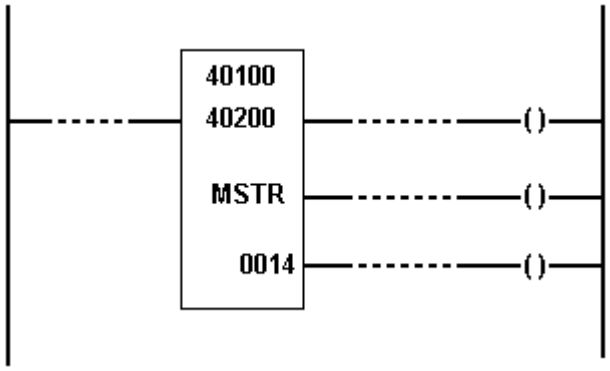
Holding Registers 40203 through 40208 contain a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035 with a date of May 14, 1997 and time 11:43:09.98.

The network address of the sending programmable controller is the Modbus Plus Routing Path from the SA85 back to the sending controller.

- For local data, the path is only 1 address long and the sending controller's Modbus Plus address is put into the lower byte of the first holding register. The other two holding registers are set to zero.
- For bridged data, the path may be 5 addresses long. The example above shows the path 6.4.0.0.0.

Sample MSTR Block - Uncompressed Timestamping

The diagram below summarizes the use of the MSTR block to send unsolicited data with uncompressed timestamping to the CIMPLICITY HMI Modbus Plus communication enabler from a device.



In this example:

- The Control Block, found in Holding Registers 40100 through 40108, contains control information for the MSTR block. These indicate that nine registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001.

  The CIMPLICITY HMI Modbus Plus Device Communications Enabler does not use address information configured in the control block. Instead, it interprets the data area as a command.
- The Data Block, found in Holding Registers 40200 through 40214, contains a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035 with an uncompressed timestamp.

Control Block with Uncompressed Timestamping

The Control Block used to send the sample data with uncompressed timestamping is stored in Holding Registers 40100 through 40108. Values stored in the Control block are:

	Register	Local Example	Bridge Example	
Write Command	40100	1	1	
Status Word	40101	xxxxx	xxxxx	
Number of registers to send	40102	14	14	
Destination HR in Slave device	40103	40001	40001	
SA85 Modbus Plus address (1-64)	40104	9	7	*
SA85 Slave channel (1-8)	40105	1	9	**
Routing Parameter	40106	0	1	***
Routing Parameter	40107	0	0	
Routing Parameter	40108	0	0	

* Bridge address
** Modbus Plus address of SA85
*** Slave channel

These Holding Registers indicate that 14 registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001

Data Area with Uncompressed Timestamping

The Data Area used to send the sample data with uncompressed timestamping is stored in Holding Registers 40200 through 40213. The sample data being sent is:

	Register	Local Example	Bridge Example
Network address of sending PLC	40200	1	0406
	40201	0	0
	40202	0	0
Address of point receiving unsolicited data	40203	30017	30017
Number of bytes of data.	40204	32770	32770
First timestamp word	40205	0	0
Second timestamp word	40206	5	5
Third timestamp word	40207	14	14
Fourth timestamp word	40208	1997	1997
Fifth timestamp word	40209	11	11
Sixth timestamp word	40210	43	43
Seventh timestamp word	40211	09	09
Eighth timestamp word	40212	98	98
The unsolicited value	40213	21035	21035

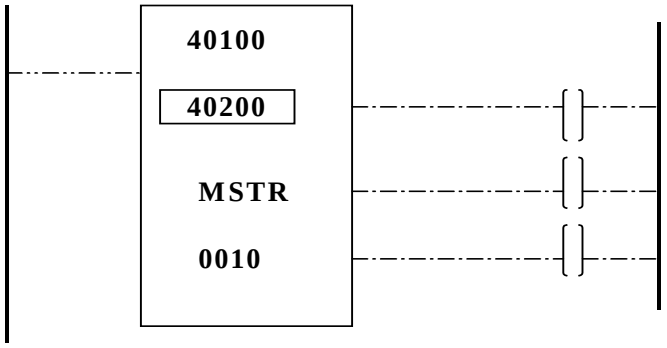
Holding Registers 40203 through 402058 contain a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035 with a date of May 14, 1997 and time 11:43:09.98.

The network address of the sending programmable controller is the Modbus Plus Routing Path from the SA85 back to the sending controller.

- For local data, the path is only 1 address long and the sending controller's Modbus Plus address is put into the lower byte of the first holding register. The other two holding registers are set to zero.
- For bridged data, the path may be 5 addresses long. The example above shows the path 6.4.0.0.0.

Sample MSTR Block - Compressed Timestamping with mSecs

The diagram below summarizes the use of the MSTR block to send unsolicited data with compressed timestamping with mSecs to the CIMPLICITY HMI Modbus Plus communication enabler from a device.



In this example:

- The Control Block, found in Holding Registers 40100 through 40108, contains control information for the MSTR block. These indicate that nine registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001.

- The CIMPLICITY HMI Modbus Plus Device Communications Enabler does not use address information configured in the control block. Instead, it interprets the data area as a command.

- The Data Block, found in Holding Registers 40200 through 40209, contains a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035 with a compressed timestamp.

Control Block with Compressed Timestamping with mSecs

The Control Block used to send the sample data with compressed timestamping is stored in Holding Registers 40100 through 40108. Values stored in the Control block are:

	Register	Local Example	Bridge Example	
Write Command	40100	1	1	
Status Word	40101	Xxxxx	xxxxx	
Number of registers to send	40102	10	10	
Destination HR in Slave device	40103	40001	40001	
SA85 Modbus Plus address (1-64)	40104	9	7	*
SA85 Slave channel (1-8)	40105	1	9	**
Routing Parameter	40106	0	1	***
Routing Parameter	40107	0	0	
Routing Parameter	40108	0	0	

* Bridge address
** Modbus Plus address of SA85
*** Slave channel

These Holding Registers indicate that nine registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001

Data Area with Compressed Timestamping with mSecs

The Data Area used to send the sample data with compressed timestamping is stored in Holding Registers 40200 through 40208. The sample data being sent is:

	Register	Local Example	Bridge Example
Network address of sending PLC	40200	1	0406
	40201	0	0
	40202	0	0
Address of point receiving unsolicited data	40203	30017	30017
Number of bytes of data.	40204	32770	32770
First timestamp word	40205	16384	16384
Second timestamp word	40206	10201	10201
Third timestamp word	40207	29419	29419
Fourth timestamp word	40208	22477	22477
The unsolicited value	40209	21035	21035

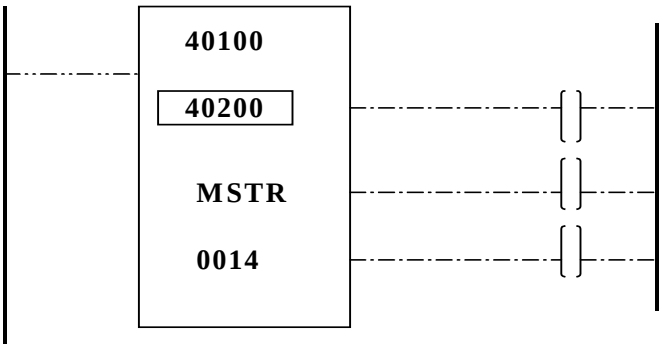
Holding Registers 40203 through 40209 contain a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035 with a date of May 14, 1997 and time 11:43:09.985.

The network address of the sending programmable controller is the Modbus Plus Routing Path from the SA85 back to the sending controller.

- For local data, the path is only 1 address long and the sending controller's Modbus Plus address is put into the lower byte of the first holding register. The other two holding registers are set to zero.
- or bridged data, the path may be 5 addresses long. The example above shows the path 6.4.0.0.0.

Sample MSTR Block - Uncompressed Timestamping with mSecs

The diagram below summarizes the use of the MSTR block to send unsolicited data with uncompressed timestamping to the CIMPLICITY HMI Modbus Plus communication enabler from a device.



In this example:

- The Control Block, found in Holding Registers 40100 through 40108, contains control information for the MSTR block. These indicate that nine registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001.
- The CIMPLICITY HMI Modbus Plus Device Communications Enabler does not use address information configured in the control block. Instead, it interprets the data area as a command.
- The Data Block, found in Holding Registers 40200 through 40214, contains a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035 with an uncompressed timestamp.

Control Block with Uncompressed Timestamping with mSecs

The Control Block used to send the sample data with uncompressed timestamping is stored in Holding Registers 40100 through 40108. Values stored in the Control block are:

	Register	Local Example	Bridge Example	
Write Command	40100	1	1	
Status Word	40101	xxxxx	xxxxx	
Number of registers to send	40102	14	14	
Destination HR in Slave device	40103	40001	40001	
SA85 Modbus Plus address (1-64)	40104	9	7	*
SA85 Slave channel (1-8)	40105	1	9	**
Routing Parameter	40106	0	1	***
Routing Parameter	40107	0	0	
Routing Parameter	40108	0	0	

* Bridge address
** Modbus Plus address of SA85
*** Slave channel

These Holding Registers indicate that 14 registers worth of data will be sent to the device at Modbus Plus address 9, Slave Channel 1 (9.1.0.0.0) and stored starting at address 40001

Data Area with Uncompressed Timestamping with mSecs

The Data Area used to send the sample data with uncompressed timestamping is stored in Holding Registers 40200 through 40213. The sample data being sent is:

	Register	Local Example	Bridge Example
Network address of sending PLC	40200	1	0406
	40201	0	0
	40202	0	0
Address of point receiving unsolicited data	40203	30017	30017
Number of bytes of data.	40204	32770	32770
First timestamp word	40205	24576	24576
Second timestamp word	40206	5	5
Third timestamp word	40207	14	14
Fourth timestamp word	40208	1997	1997
Fifth timestamp word	40209	11	11
Sixth timestamp word	40210	43	43
Seventh timestamp word	40211	09	09
Eighth timestamp word	40212	985	985
The unsolicited value	40213	21035	21035

Holding Registers 40203 through 40208 contain a command to the CIMPLICITY HMI Modbus Plus communications enabler to set the value of a point at Input Register 17 to a value of 21035 with a date of May 14, 1997 and time 11:43:09.985.

The network address of the sending programmable controller is the Modbus Plus Routing Path from the SA85 back to the sending controller.

- For local data, the path is only 1 address long and the sending controller's Modbus Plus address is put into the lower byte of the first holding register. The other two holding registers are set to zero.

- For bridged data, the path may be 5 addresses long. The example above shows the path 6.4.0.0.0.

Modbus Plus Advanced Configuration Topics

DC_ASCII_REVERSE

By default, CIMPLICITY stores Text class (string) point data the same way that ModSoft does. It is NOT necessary to modify the Global Parameters file to make CIMPLICITY and ModSoft store strings using the same method. In other words, DC_ASCII_REVERSE is now YES by default.

If you do NOT want CIMPLICITY to store string data the same way ModSoft does. If you want to preserve the method of string storage that CIMPLICITY has used in the past, then you MUST modify the Global Parameters file in the Master directory of your project.

The procedure is as follows:

1. Open the CIMPLICITY Configuration program, then open your project (*.gef) file.
2. From the **Tools** pulldown menu, select **Command Prompt**.
3. At the Command Prompt, type:
4. CD MASTER <enter>
5. IDTPOP GLB_PARMS <enter>
6. Use NOTEPAD or some other ASCII editor to modify the file GLB_PARMS.IDT
7. Add a new line at the bottom of the file**:**
   DC_ASCII_REVERSE|1|NO
8. Save the file, and exit the editor.
9. From the Command Prompt, type: SCPOP GLB_PARMS <enter>
10. Start your project

Modbus Plus Query Command Support

All Modbus Plus devices must be up and connected before a CIMPLICITY HMI project is started, unless they support the Modbus Plus query command. Devices that support the query command do not need to be on-line when a CIMPLICITY HMI project is started. You can use two logical names to tell the Modbus Plus Communications enabler to support the query command for all or some devices.

MD_QUERY_ALL

If all devices on the port support the Modbus Plus query command, define the following logical in **`%SITE_ROOT%\data\log_names.cfg`**:

```
MD_QUERY_ALL|P|default|6|TRUE
```

MD_QUERY_<device_id>

If some, but not all devices on the port support the Modbus Plus query command, define the following logical for each device that supports it:

MD_QUERY_<device_id>|P|default|6|TRUE

where **<device_id>** is the name of the device.

Supporting PCs without General Reference Memory

By default, the Modbus Plus Communications enabler attempts to validate the General Reference memory on all devices when it initializes. You can use two logical names to tell the Modbus Plus Communications enabler to skip this validation for all or some devices.

MD_SKIP_GENREF_ALL

To skip the validation of General Reference memory on all devices, define the following logical in **%SITE_ROOT%\data\log_names.cfg**:

MD_SKIP_GENREF_ALL|P|default|6|TRUE

where **<device_id>** is the name of the device.

MD_SKIP_GENREF_<device_id>

To skip the validation of General Reference memory for specific devices, define the following logical in **%SITE_ROOT%\data\log_names.cfg**:

MD_SKIP_GENREF_<device_id>|P|default|6|TRUE

where **<device_id>** is the name of the device.

SA85_DRIVER_TIMEOUT

By default, the Modbus Plus driver takes 10 seconds to time out after sending a request. You can adjust this time-out parameter for your configuration.

To define a SA85 driver time-out, add the following to the global parameter file:

SA85_DRIVER_TIMEOUT|1|<value>

where **<value>** is the time-out value in tenths of seconds.

For example,

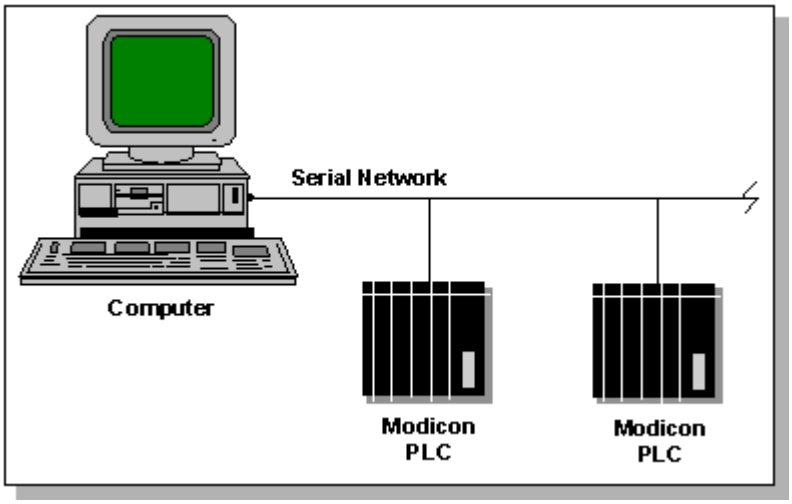
SA85_DRIVER_TIMEOUT|1|50

defines a time-out of 5 seconds.

Modbus RTU Communications

About Modbus RTU

The Modbus RTU Communications option supports a multi-drop configuration with the Modbus RTU Communications enabler functioning as the master. You must configure a CIMPLICITY HMI device for each physical device (or slave) from which data will be collected.



This communications option supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This communications option supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Modbus RTU Supported Devices

The Modbus RTU Communications option supports communications to the following programmable controllers:

- GE Fanuc Series Six with CCM3 card (Version 1.06 or later)
- 3720 ACM Electronic Power Meter (Firmware Version 1.5 or later is required if you want to read/write negative numbers)
- Modicon 484
- Modicon 584
- Modicon 884
- Modicon 984
- Modicon Micro 80

Modbus RTU Supported Memory Types

The Modbus RTU Communications option supports the following memory types on GE Fanuc Series Six and Modicon programmable controllers:

Series Six Controllers

The Modbus RTU Communications option supports reads from the following memory types on Series Six with CCM3 in RTU mode:

Output Table	0xxxx or 0xxxxx
Input Table	1xxxx or 1xxxxx
Registers	3xxxx or 3xxxxx
	4xxxx or 4xxxxx
General Reference	6yxxxx or 6yxxxxx

The Modbus RTU Communications option supports writes to the following memory types on Series Six with CCM3 in RTU mode:

Output Table	0xxxx or 0xxxxx
Registers	4xxxx or 4xxxxx
General Reference	6yxxxx or 6yxxxxx

3720 ACM Electronic Power Meter

To successfully communicate with the 3720 ACM Electronic Power Meter, you must:

- Set Register Size to 32 bits in the ACM.
- Set **Invalid objects** to **Yes** in the 3720 ACM.
- Use Firmware Version 1.5 or later if you are going to read/write negative numbers.

The Modbus RTU Communications option supports reads and writes from the following memory types on a 3720 Electronic Power Meter operating in 32 bit register size mode:

32 bit Registers	4xxxxor 4xxxxx
32 bit Registers in mod 10000 format	D4xxxx or D4xxxxx

Modicon Controllers

The Modbus RTU Communications option supports reads from the following memory types on Modicon controllers:

Coils	0xxxx or 0xxxxx
Inputs	1xxxx or 1xxxxx
Input Registers	3xxxx or 3xxxxx
Holding Registers	4xxxx or 4xxxxx
General Reference	6yxxxx or 6yxxxxx
Holding Registers as Double Precision	D4xxxx or D4xxxxx

The Modbus RTU Communications option supports writes to the following memory types on Modicon controllers:

Coils	0xxxx or 0xxxxx
Holding Registers	4xxxx or 4xxxxx
General Reference	6yxxxx or 6yxxxxx
Holding Registers as Double Precision	D4xxxx or D4xxxxx

Caution

When writing to Coils (0xxxx or 0xxxxx), memory protect and coil disable are overwritten.

On Modicon controllers, coils that are not programmed in the controller logic program are not automatically cleared on powerup. This means that if a coil is set to 1, the output will remain HOT until explicitly set to 0.

Writing to Holding Registers overrides the controller memory protect.

Double Precision Notes

D4xxxx(x) points are Holding Register Points interpreted as Double Precision. Two registers are used for each point with both registers are assumed to have a positive value.

Because of this mapping:

- Do not declare Double Precision points with overlapping addresses. For example, D40001 and D40002 overlap, while D40001 and D40003 do not.
- Do not define points that use the same Holding Register and Double Precision point address (for example, defining one point with the address D40001 and another with the address 40001).

Configure Double Precision points as **DINT** or **UDINT** point.

Arrays are not supported for Double Precision points.

Modbus RTU Required Documents

You should have the following document available when configuring a Series Six for Modbus RTU communications:

Series Six Programmable Controllers Data Communications Manual (GEK-25364)

You should have the following document available when configuring a 3720 ACM Electronic Power Meter for Modbus RTU communications:

3720 ACM / Modbus Serial Communications Protocol

For all other programmable controllers, you should have the documentation for the controller available.

Modbus RTU Hardware Configuration Requirements

The Modbus RTU protocol allows one master and up to 247 slaves on a common line. In CIMPLICITY HMI software, the Modbus RTU Communications Enabler is the master.

Many configurations limit the number of slaves to a smaller number. For example, Gould's J478 modem restricts the number of slaves to 32. Contact your hardware vendor for information about the number of slaves that your hardware configuration can support.

Modbus RTU Hardware Installation

When installing Modbus RTU hardware, you should be aware of the following:

Modbus RTU Controller Configuration

When configuring a controller for use with a CIMPLICITY HMI project, do the following:

1. Configure the controller/communications card for Modbus RTU communications.
2. Assign each slave within the configuration a unique slave address between 1 and 247 (decimal).
3. Configure all slaves at the same baud rate and parity as the master (the Modbus RTU Communications enabler).

Connecting to a Series Six

To connect a personal computer to a Series Six with a CCM3 card installed, refer to the ***Series Six Programmable Controllers Data Communications Manual*** (GFK-25364).

Modbus RTU Serial Port Configuration

Most personal computers come with two (2) serial communication ports. You may use either port for Modbus RTU device communications. No special port configuration is required.

You may also connect to Modbus RTU devices over a terminal server using Telnet or TCP protocol.

Validating Modbus RTU Communications

The Modbus RTU Communications option includes a diagnostic program called **mb_test.exe**. You can use **mb_test** to perform read tests for each of the supported memory types.

Before you can use this program, you must successfully install the CIMPLICITY HMI Modbus RTU Communication option and configure the Modbus RTU ports and devices using CIMPLICITY HMI application configuration functions.

You *cannot* use this program while you are running the Modbus RTU device communication enabler over the same communications port.

To start the program:

1. Open the Workbench for the project where the Modbus RTU driver is configured.
2. Stop the project.
3. From the **Tools** menu, select **Command Prompt...** to open the Command Prompt window for your project.
4. In the Command Prompt window, type the command to invoke the diagnostic test you wish to perform.

The format for the command is:

```
mb_test [-B<baud rate>] [<parity>] [-T<port_id >]
[-S<slave id>] [-R<address>] [-C<count>]
```

where:

-B<baud rate>	Defines the speed of the terminal line. Default value is 9600.
<parity>	Defines the parity for communications. Choose one of the following: **-E** Defines EVEN parity. **-O** Defines ODD parity. **-N** Defines NO parity. If no parity is specified, the default is EVEN parity.
-T<port_id>	Defines the port to be used for communications. Default value is COM1.
-S<slave id>	Defines the slave to be addressed. Default value is 1.
-R<address>	Defines where on the slave controller a read should begin. Default is no read, just device connect.
-C<count>	Defines the number of elements to be read. Default value is 1 element. For the 3270 ACM, set **<count>** to an even number greater than or equal to 2.

For example, the command to read the first five holding registers on slave 7 from COM1 at 4800 baud using ODD parity is:

```
$ mb_test -B4800 -O -S7 -TCOM1 -R40001 -C5
```

Modbus RTU Communications Problem Checklist

If communications between the Modbus RTU Communications enabler and the controller are unsuccessful, use the following checklist to help find where the problem exists:

1. Verify that the COM port is configured in the system.
2. Verify that the cable between the computer and the controller is correctly wired.
3. Verify that the baud rate and parity on the computer are consistent with those on the controller.
4. Verify that the controller's Modbus port is configured for RTU communications.
5. Verify that the slave address is correct.

Modbus RTU Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to Modbus RTU communications.

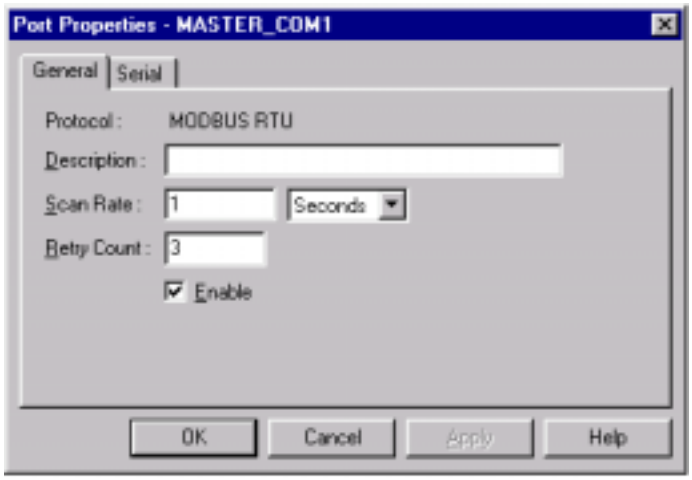
Modbus RTU Port Configuration

When you create a new port for Modbus RTU communications, enter the following information in the New Port dialog box:

1. In the **Protocol** field, select **MODBUS RTU** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for Modbus RTU communications.

When you click **OK** to create the port, the Port Properties dialog box for the protocol opens.

General Port Properties



Use the General properties to enter general information for the port. You can define the following:

Description Enter an optional description to help you identify the port.

Scan Rate Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

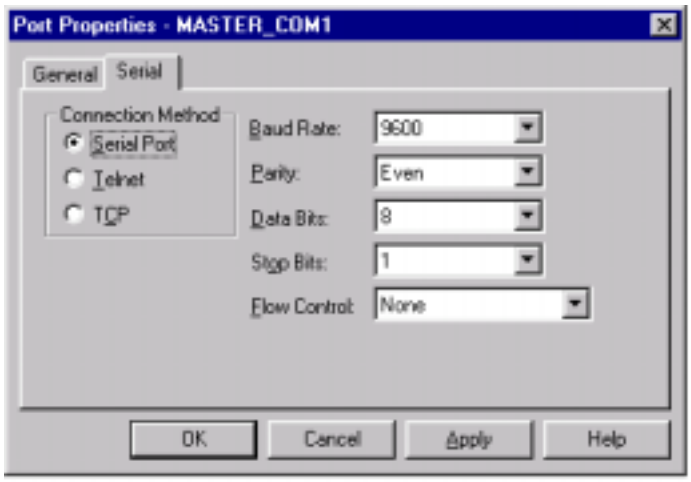
You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Serial Port Properties: Serial Port Connection

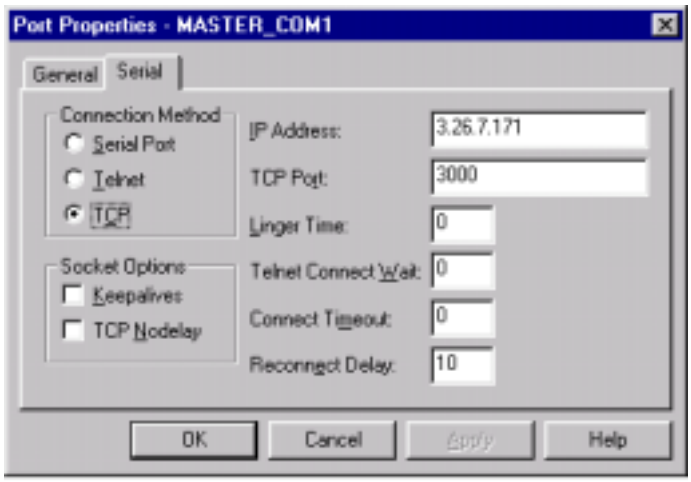


If you select the serial port connection method, you need to define the following:

Baud Rate	Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.
Data Bits	Select the number of data bits per word to be used for communications.
Parity	Select the parity to be used for communications.
Stop Bits	Select the number of stop bits to be used for communications
Flow Control	Select the type of flow control to be used for communications. If you change the Flow Control type, you must reboot the PC for the changes to take affect.

Remember that you must configure the same baud rate, data bits, parity, stop bits and flow control for all PLCs using the serial port.

Serial Port Properties: Telnet or TCP Connection



If you select the Telnet or TCP connection method, you need to define the following:

Socket Options	Set the **Keepalives** check box to use keepalives to detect the loss of the terminal server. Clear the check box if you do not want to use keepalives to detect the loss of the terminal server. Set the **TCP Nodelay** check box if you want to set the Nodelay flag on the socket. Clear the check box if you do not want to set the Nodelay flag.
IP Address	Enter the IP address of the terminal server.
TCP Port	Enter the port number of the TCP port on the terminal server.
Linger Time	Enter the time in seconds to wait after closing the socket before aborting the socket.
Telnet Connect Wait	Enter the time in seconds to wait for the Telnet protocol to initialize.
Connect Timeout	Enter the time in seconds to wait for the TCP connection to form.
Reconnect Delay	Enter the time in seconds to wait before attempting to reconnect to a device. If you set this value to zero and the terminal server is not available, then no attempts will be made to reconnect to the terminal server.

Terminal Server Setup

Each port on the terminal server to which the Modbus RTU option is connected must be configured for TCP/IP communications. Use the following steps to configure your terminal server:

1. Log into your terminal server, and set privileged mode by issuing the following command. Enter the privileged password when prompted (typically "system"):

   ```
   > set priv
   Password>
   ```

2. Enter the following command so that the permanent database and the operational database will be updated when a **`define`** command is issued:

   ```
   >> set server change enabled
   ```

3. For each port to which a marquee is attached, enter the following set of commands where:

   `<port>` is the actual port number to which the marquee is attached. Note that it is possible to specify a range of port numbers instead of a single port (for example, *1-10* signifies ports 1 through 10).

   `<ip_port>` is the telnet port number.

   `<parity>` is odd, even, or none.

   `<stop bits>` is the number of stop bits.

   `<speed>` is the baud rate of the marquee.

```
>> define port <port> access remote
>> define port <port> telnet remote <ip_port>
>> define port <port> telnet transmit immediate
>> define port <port> parity <parity>
>> define port <port> character size 8
>> define port <port> stop bits <stop bits>
>> define port <port> autobaud disabled
>> define port <port> speed <speed>
>> define port <port> line editor disabled
>> define port <port> telnet csi escape enabled
>> define port <port> telnet binary session mode passall
>> define port <port> loss notification disabled
>> define port <port> autoprompt disabled
>> define port <port> verification disabled
>> define port <port> outboundsecurity disabled
>> define port <port> broadcast disabled
>> define port <port> default session mode transparent
>> define port <port> internet tcp keepalive 2
```

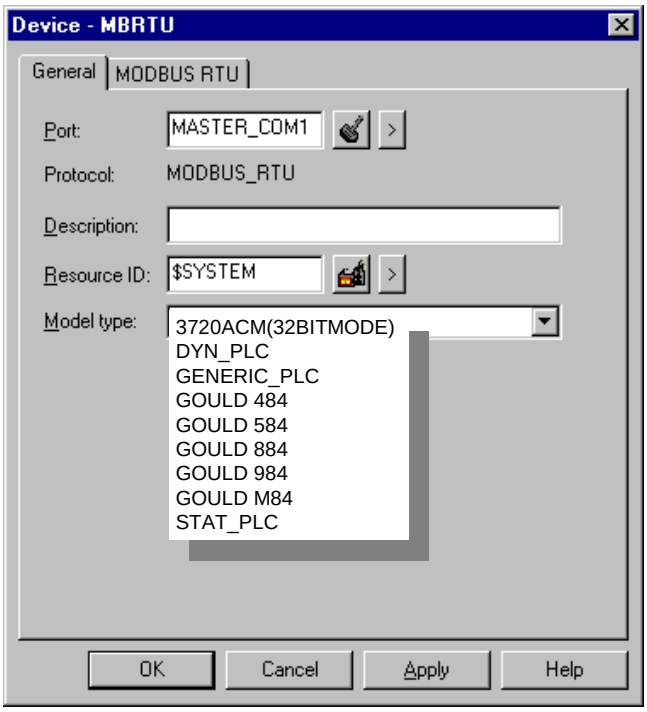
Modbus RTU Device Configuration

When you create a new device for Modbus RTU communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Modbus RTU port to be used by the device.

When you click **OK** to create the device, the Device dialog box opens.

General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices and make a selection. For this protocol, the choices are:

3720ACM(32BITMODE)
DYN_PLC
GENERIC_PLC
GOULD 484
GOULD 584
GOULD 884
GOULD 984
GOULD M84
STAT_PLC

If your device model is not displayed in the selection list, select either **STAT_PLC** for a non-qualified controller with static domain sizing or **DYN_PLC** for one with dynamic domain sizing.

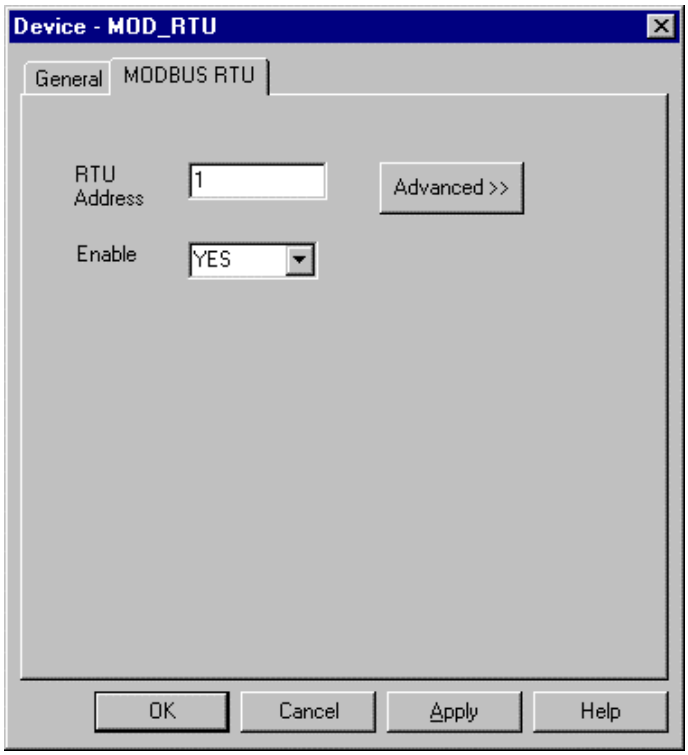
If you select **STAT_PLC**, the size of the registers is fixed at the maximum possible size.

If you select **DYN_PLC**, the size of the registers is determined at run-time.

For the 3720 ACM Electronic Power Meter:

- Use **3270ACM(32BITMODE)** only when the meter is configured for 32 bit Register Size.
- Use **STAT_PLC** or **DYN_PLC** if the meter is not
- Use **GENERIC_PLC** to select Advanced Configuration for selecting memory sizes and read/write functions..

MODBUS RTU Device Properties



Use the MODBUS RTU tab in the Device dialog box to enter information about Modbus RTU communications for the device. You can define the following:

Address Enter the slave address of the device. For the Series Six, this is the **CPU ID** of the attached Series Six.

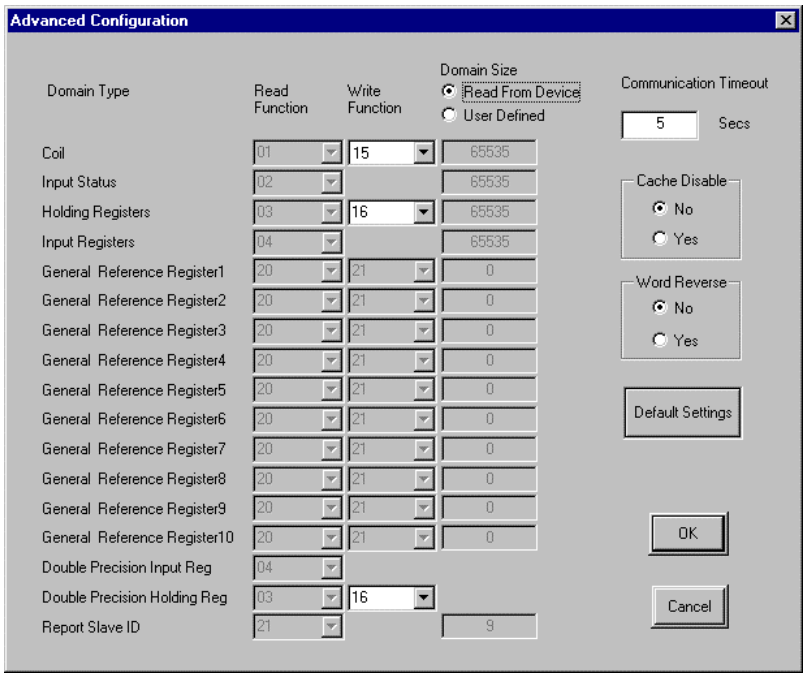
Valid slave addresses range from 1 to 247 decimal.

Broadcast mode (slave address 0) is *not* supported by the Modbus RTU device communications enabler.

Enable Select Yes to enable the device when the project starts. If you select No, the device will not be enabled and points associated with the device will be unavailable.

Advanced Select the GENERIC_PLC model in the Model type field on the General tab to enable the **Advanced** button. This configuration allows varying the memory sizes and Modbus RTU read/write functions can be enabled/disabled or selected.

Advanced Modbus RTU Device Configuration



Fields in the Advanced Configuration dialog box are as follows:

Read Function	The function used for reading the domain can be selected through a drop down combo box. In many cases, only one command can be used. These combo boxes will be disabled.
Write Function	The function for writing domain data can be selected through the drop down combo box. In many cases, only one command can be used. These combo boxes will be disabled.
Read From Device	By default the domain sizes are set by reading from the hardware.
User Defined	The domain sizes can be varied by selecting the radio button. The respective sizes can be entered in domain size field. Zero domain size indicates that it is an invalid domain. Read or write is not supported.
Communi-cation TimeOut	This is the number of seconds the devcom will wait for a response to a poll request before declaring a read failure.
Cache Disable	By default, CIMPLICITY caches continuous addresses into a cache group. It then performs a single read on the group. Some devices will not allow this kind of group read. When caching is disabled, each point is read individually from the device. Note that in large point count projects, this can significantly affect performance.
Word Reverse	This affects four byte values only (REAL, DINT, UDINT). Some devices store the LOW WORD and HIGH WORD in reverse order (from a Modicon PLC). This will reverse them so they are displayed correctly in CIMPLICITY.

Default Settings	The page will be updated with default settings of the domains.
Ok	This updates the domain sizes in the \\SITE_ROOT:data\MASTER_COM1.ini file or in '\\SITE_ROOT:data\MASTER_[PORT NUMBER] 'as per the selected port. This file is read during devcom initialization to enable or disable the respective domains.
Cancel	Closes the device dialog box without any modification.

Modbus RTU Point Configuration

Once your devices are configured, you may configure points for them. Through device point configuration, you may configure the following:

- Points that read or set Coils
- Points that read Discrete Inputs
- Points that read Input Registers
- Points that read or set Holding Registers
- Points that read or set General Reference
- Points that read or set Holding Registers as Double Precision

The fields described below have configuration values that are unique to, or have special meaning for Modbus RTU communications.

General Point Properties

On the General page, the type of **Access** you choose depends on the point address:

- Select **Read** for points from Discrete Inputs or Input Registers.
- Select **Read/Write** for points from Coils or Holding Registers.

Device Point Properties

On the *Device* page, the following fields have special meaning for the Modbus RTU Communications option:

Update Criteria The update criteria you select determines how the data will be requested.

Select **On Scan** or **On Change** for points whose values should be polled by Modbus RTU communications at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by Modbus RTU communications at regular intervals while users are viewing them..

Address Enter the point address of the data as follows:

`0xxxx` or **`0xxxxx`** for Coils

`1xxxx` or **`1xxxxx`** for Discrete Inputs

`3xxxx` or **`3xxxxx`** for Input Registers

`4xxxx` or **`4xxxxx`** for Holding Registers

`6yxxxx` or **`6yxxxxx`** for General Reference

`D4xxxx` or **`D4xxxxx`** for Holding Registers as Double Precision. For the 3270 ACM meter, this address represents a register whose value is expressed in mod 10000 format.

where **`xxxx`** or **`xxxxx`** is the bit number or register number of the point. For example, the address of Holding Register one is 40001 and the address of Coil one is 00001.

If you are configuring a General Reference point, the file number is **`y`**.

Double Precision points in Holding Registers require two Holding Registers per point. The upper register is multiplied by 10000 and the product is added to the lower register to get the resulting value. No more than one Double Precision point may be written in a single write operation. Use **DINT** or **UDINT** types for these points.

If you are configuring an Analog point type in Discrete Inputs or Coils, the address entered in this field must be that of the least significant bit of the point.

For example, to configure a 16-bit analog point for Coils 17 through 32, enter 00017 in this field.

When you configure Boolean points in Holding Registers, Input Registers or General Reference, you must also enter data in the following field:

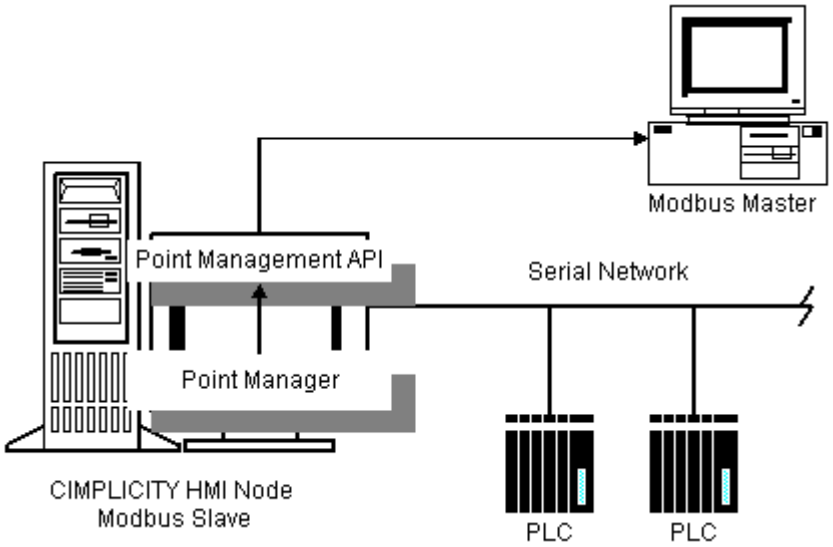
Bit Offset Enter the bit offset in the Holding Register, Input Register, or General Reference that defines the point, where 0 is the least significant bit and 15 is the most significant bit.

Modbus RTU Slave Communications

Modbus RTU Slave Communications Overview

The Modbus RTU Slave Communications option supports a multi-drop configuration with the Modbus RTU Slave Communications enabler functioning as a slave. In effect, the Modbus RTU Slave Communications enabler presents the CIMPLICITY HMI Points as if they were data values from one or more Modbus RTU Slave devices.

The CIMPLICITY Points are mapped to Modbus Addresses, allowing a Modbus Master to obtain Point Values as if they were coils or registers on a Slave device.



SystemLink uses the Modbus RTU Slave feature to enable CIMPLICITY to collect point values over the Internet using the Modbus protocol. The node that is set up as the Modbus Master can collect data from the Modbus Slave nodes via the Internet.

Modbus RTU Slave Specifications

CIMPLICITY HMI Specifications for Modbus RTU Slave

Supported Data Types

This communications option supports the following data types:

- Boolean
- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Arrays of the above data types

Modbus RTU Slave Protocol

Transmission Mode Supported by Modbus RTU Slave

The Modbus RTU Slave Communications option supports the RTU transmission mode.

Message Framing Supported by Modbus RTU Slave

The Modbus RTU Slave Communications option supports RTU framing. RTU framing implies the following communication parameters:

- Data bits: 8
- Start bits: 1
- Parity: Even, Odd, or None
- Stop bits: 1 or 2
- Error checking method: CRC

Modbus RTU Slave Device Emulation

The Modbus RTU Slave Communications option emulates one or more generic Modicon programmable controllers. Valid slave addresses: 1 to 127.

Memory Types Supported by Modbus RTU Slave

The Modbus RTU Slave Communications option emulates the Modbus memory types based on Modicon programmable controllers.

The Modbus RTU Communications option supports writes to the following memory types:

Memory Type	Reference Class	Description
Coils	0X	Discrete Outputs
Holding Registers	4X	Analog Outputs

The Modbus RTU Slave Communications option supports reads from the following memory types:

Memory Type	Reference Class	Description
Coils	0X	Discrete Outputs
Inputs	1X	Discrete Inputs
Input Registers	3X	Analog Inputs
Holding Registers	4X	Analog Outputs

Function Codes Supported by Modbus RTU Slave

The Modbus RTU Slave Communications option supports the Modbus function codes listed in the following table. As well, the maximum number of coils or registers that may be specified or included in a single Modbus message is also given.

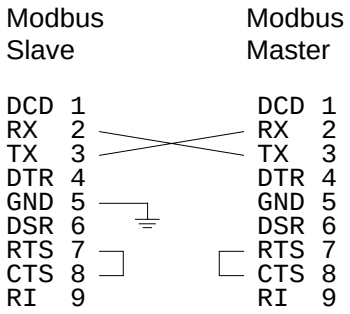
Function Code	Description	Maximum # of coils / registers
1	Read Coil Status	2000
2	Read Input Status	2000
3	Read Holding Registers	125
4	Read Input Registers	125
5	Force Single Coil	1
6	Force Single Register	1
15 (0x0F)	Force Multiple Coils	800
16 (0x10)	Preset Multiple Registers	100

Following Modbus RTU Slave Cabling Requirements

RS-232 Interface Cable

Note: the Modbus RTU Slave Interface requires RTS/CTS hardware flow control.

The cabling diagram below illustrates the interface for a serial board DB-9 connector to DB-9 connector.



RS-422 Interface Cable

Refer to documentation provided with the RS-422 serial board.

Required Documents

The Modbus RTU Slave Communications enabler adheres to the Modbus protocol specification as defined in the following document:

Modicon Modbus Protocol Reference Guide (PI-MBUS-300), Rev. J, June 1996

Procedure for Getting Modbus RTU Slave Started

The CIMPLICITY HMI Modbus RTU Slave Interface provides a way to access CIMPLICITY HMI points as Modbus coils and/or registers from Modbus master devices. This section guides a user through the steps to become familiar with the Modbus RTU Slave Interface application and to start using the application quickly.

The following getting started guide assumes that the Modbus RTU Slave Interface has been successfully installed and that at least one CIMPLICITY HMI project has been created.

Steps include:

Step 1. Identify CIMPLICITY HMI Points.

Step 2. Map points to Modbus data addresses.

Step 3. Select the Modbus RTU Slave protocol.

Step 4. Start the CIMPLICITY HMI project.

Step 5. Start the Modbus Master.

Step 6. Validate communications.

Step 1. Identify CIMPLICITY HMI Points

Identify the CIMPLICITY HMI points you wish to access from a Modbus master device. If necessary, create device or virtual points to receive values from a Modbus master device. Create virtual points to re-range analog point values to prevent data coercion errors, or to minimize loss of significance. For example, real values are truncated when transferred to a Modbus analog data address.

Step 2. Map Points to Modbus Data Addresses

Map (link) CIMPLICITY HMI points to Modbus data addresses by creating register-mapping definitions within the configuration file. *See the section "Register Mapping Records" in this chapter.*

To maximize throughput:

1. Map:
   - Boolean points to coil (0X) or input status (1X) data addresses.
   - Analog points to input register (3X) or holding register (4X) data addresses.

   Avoid gaps in allocated data addresses. *See the section "Using Register Mappings Guidelines" in this chapter for other tips.*
2. Edit the configuration file to specify the
   - Communications port parameters,
   - Trace log parameters, and
   - Modbus register limits.

   See the section "Reviewing Types of Modbus RTU Slave Configuration Records" for details.

Step 3. Select the Modbus RTU Slave Option

See the section "Step 2 of 3. Select the Modbus RTU Slave Protocol" to add the Modbus RTU Slave Interface to your CIMPLICITY HMI project.

Step 4. Start the CIMPLICITY HMI Project

You start the associated CIMPLICITY HMI project before you start the Modbus RTU Slave Interface.

To start the associated CIMPLICITY HMI project:

1. Load the project from the CIMPLICITY HMI Workbench application.
2. Either:
   A. Select Run from the Workbench Project pull-down menu, or

   B. Click the **Run** button on the Workbench toolbar.
3. Check the list of started resident processes for the name **`MRTUSI_RP`**.

Step 5. Start the Modbus Master

At this point, the Modbus RTU Slave Interface is ready to process Modbus Master requests. Start the Modbus Master device according to the documentation provided with the device.

Step 6. Validate Communications

CIMPLICITY HMI provides a number of diagnostic tools to validate communications between CIMPLICITY HMI and the Modbus master. For example, use the CIMPLICITY Point Control Panel to display CIMPLICITY HMI points. *See the section "Modbus RTU Slave Troubleshooting" for details of other diagnostic tools.*

Modbus RTU Slave Configuration Overview

This section describes the configuration process for the Modbus RTU Slave Interface. To configure the Modbus RTU Slave Interface, follow these steps:

Step 1. Edit the configuration file.

Step 2. Select the Modbus RTU Slave protocol.

Step 3. Implement the Modbus RTU Slave configuration.

Step 1 of 3. Edit the Modbus RTU Slave Configuration File

When a new CIMPLICITY HMI project is created, a template configuration file is created for the Modbus RTU Slave Interface. The file has a comma-separated value (CSV) format similar to the format used by the CIMPLICITY HMI import/export utility.

Modify the configuration file to specify the:

- Communications port parameters
- Trace log parameters
- Modbus register limits
- Point / register mappings.

Understanding the File Naming Convention

The Modbus RTU Slave Interface determines the file specification of the configuration file at startup by combining the file name **`MRTUSI_RP.CFG`** with the file path of the Project directory.

Example

If the project has been created in the directory

`C:\CIMPLICITY\HMI\Projects\test\`

Then the configuration file specification is:

`C:\CIMPLICITY\HMI\Projects\test\data\MRTUSI_RP.CFG`.

Reviewing Types of Modbus RTU Slave Configuration Records

The configuration file may contain the following types of records:

Communications Port Parameters	Defines the serial communications port and settings.
Trace Log Parameters	Specifies the state (on/off) of protocol stack diagnostics logging.
Modbus Register Limits	Defines the range of valid values for a Modbus analog register (memory type 3X or 4X).
Register Mapping	Defines a mapping between a CIMPLICITY HMI point and a Modbus data address.
Comments	Any line beginning with one or more pound signs (#). Ignored by the Modbus RTU Slave Interface.
Blank lines	Ignored by the Modbus RTU Slave Interface.

Communications Port Parameters Record

The configuration file must contain a Communications Port Parameters record. In addition, all fields must be present.

The format for the Communications Port Parameters record is:

CP,<*port***>,<***baud rate***>,<***parity***>,<***data bits***>,<***stop bits***>**

Where

CP	Identifies the record as a communications port parameters record.
<*port*>	Physical serial port selection. Valid settings are 1 to 9.
<*baud rate*>	Throughput rate. Valid settings are hardware dependent, and may range from 1200 to 115000.
<*parity*>	Parity setting. Valid settings: None, Odd, Even.
<*data bits*>	Size of data field (in bits). Valid settings: 8.
<*stop bits*>	Number of stop bits. Valid settings: 1, 2.

Trace Log Parameters Record

The configuration file may contain a Trace Log Parameters record.

The format for the Trace Log Parameters record is:

TF,<*logging state*>

Where

TF	Identifies the record as a trace log parameters record.
<*logging state*>	Protocol stack logging state. Valid settings: On, Off. Default value: Off.

Note: If the Trace Log Parameters record is not defined, the protocol stack logging state is Off.

Trace log messages are written to the standard error file associated with the Modbus RTU Slave Interface process. *See the section "Using the Protocol Stack Trace Log" for more information.*

Modbus Register Limits Record

The configuration file may contain a Modbus Register Limits record. These limits are applied only to CIMPLICITY HMI points mapped to analog registers (register type 3X or 4X).

The format for the Modbus Register Limits record is:

RL,<*low limit*>,<*high limit*>

Where

RL	Identifies the record as a Modbus register limits record.
<*low limit*>	The minimum value accepted from a CIMPLICITY HMI point. Valid range of values: 0 to 65535. Must be less than <*high limit*>. Default value: 0.
<*high limit*>	The maximum value accepted from a CIMPLICITY HMI point. Valid range of values: 0 to 65535. Must be greater than <*low limit*>. Default value: 65535.

Note: If the Modbus Register Limits record is not defined the low and high limits are 0 and 65535, respectively.

Register Mapping Records

The configuration file must contain one or more Register Mapping records. In each Register Mapping record, all fields must be present.

The format for the Register Mapping record is:

RM,<*slave*>,<*register*>,<*point id*>

Where

RM	Identifies the record as a register mapping record.
<*slave*>	The emulated slave device address. Valid range of values: 1 to 127.
<*register*>	One-based Modbus address including the memory type prefix. See the following table for valid range of values:

Memory Type	Address range
0x - Coils (Discrete)	1 to 9999
1x - Inputs (Discrete)	10001 to 19999
3x - Input Registers (Analog)	30001 to 39999
4x - Holding Registers (Analog)	40001 to 49999

<*point id*>	String that uniquely references a point in a CIMPLICITY HMI project. Must specify a non-text attribute (i.e. analog or Boolean).

Viewing a Sample Configuration File

The following is a sample configuration file specifying register mappings for two slave devices (address 3 and 7).

```
# Modbus RTU Slave Interface - sample configuration file
#
# Communication port definition:
CP,1,19200,None,8,2

# Trace log flag definition:
TF,Off

# Modbus register limits definition:
RL,0,65535

# Register mapping definitions:

# Slave Address: 3
#
# - the following register mapping definitions specify coils for
#   slave address 3
#
RM,3,10,TEST_POINT_DOUT_1
RM,3,11,TEST_POINT_DOUT_2
RM,3,12,TEST_POINT_DOUT_3
RM,3,13,TEST_POINT_DOUT_4
#
# - the following register mapping definitions allocate a block of holding
#   registers (memory type 4X). Note that the highest register reference is
#   40104 or data address 103 (zero-based). Thus, while only 4 registers are
#   mapped to CIMPLICITY points, all 104 registers are accessible to the
#   Modbus master.
#
RM,3,40101,TEST_POINT_AOUT_2
RM,3,40102,TEST_POINT_AOUT_3
RM,3,40103,TEST_POINT_AOUT_4
RM,3,40104,TEST_POINT_AOUT_5

# Slave Address: 7
#
# - the following register mapping definitions allocate the first two data
#   addresses of each memory type for slave address 7
#
RM,7,1,TEST_POINT_DOUT_A
RM,7,2,TEST_POINT_DOUT_B
RM,7,10001,TEST_POINT_DIN_A
RM,7,10002,TEST_POINT_DIN_B
RM,7,30001,TEST_POINT_AIN_A
RM,7,30002,TEST_POINT_AIN_A
RM,7,40001,TEST_POINT_AOUT_A
RM,7,40002,TEST_POINT_AOUT_B
```

Using Register Mappings Guidelines

This section provides the user with guidelines for defining register mappings.

See the section "Expected Modbus RTU Slave Runtime Behavior" in this chapter, for further details on how the behavior of the Modbus RTU Slave Interface can affect configuration decisions.

Guideline to Organize Records

Guideline to Organize Records

The register mappings (and other types of records) may be specified in any order. To simplify maintenance of the configuration file, order the register mapping records by slave address then register reference. This will aid in detecting unmapped data addresses.

Since the Modbus RTU Slave Interface can emulate multiple Modbus RTU Slave devices, one could organize mapped CIMPLICITY HMI points into logical groupings based on a functional area.

Guideline to Optimize Throughput

Guideline to Optimize Throughput

The Modbus RTU Slave Interface supports several Modbus requests that allow a range of data addresses (or an array of values) to be specified. Note that these requests specify a contiguous set of data addresses.

To maximize throughput, avoid gaps in allocated data addresses. This will reduce the transfer of "meaningless" values.

In addition, map Boolean points to coil (0X) or input status (1X) data addresses. Modbus requests that handle coil or input status data addresses pack sixteen (16) values into one word (two bytes). Modbus requests that handle input register or holding register data addresses require one word per value.

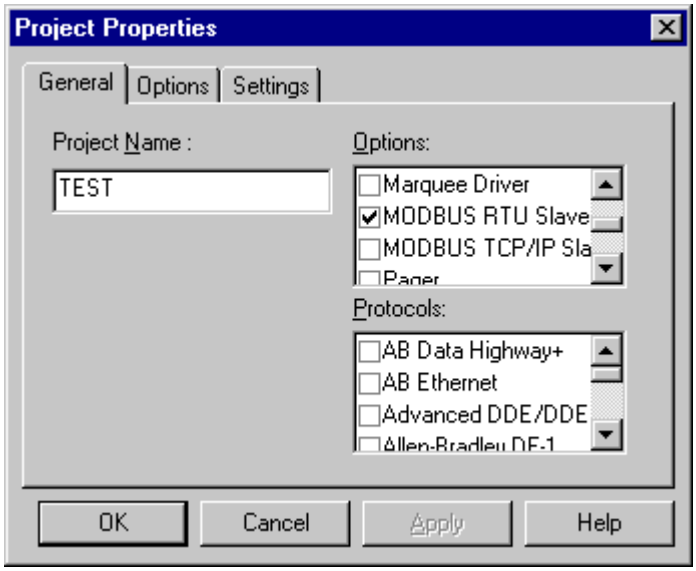
Another way to maximize throughput is to allow the Modbus master to reduce the number of transactions by increasing the range of data addresses in each request. *See the section "Function Codes Supported by Modbus RTU Slave " in this chapter for limits on the number of coils or registers that may be specified or included in a single Modbus message.*

Step 2 of 3. Select the Modbus RTU Slave Protocol

To add the Modbus RTU Slave communications enabler to your project:

1. Load an existing project (or create a new project) in the CIMPLICITY HMI Workbench.
2. Click Project on the Workbench menu bar.
3. Select Properties.

   The Project Properties dialog box opens.
4. Select the General tab.



5. Check MODBUS RTU SLAVE in the Options box.
6. Click **OK** to save the changes.

Step 3 of 3: Implement the Modbus RTU Slave Configuration

To apply Modbus RTU Slave configuration changes, start the associated CIMPLICITY HMI project. If the project is currently running, stop then restart the Modbus RTU Slave resident process.

The start order for implementing the Modbus RTU Slave configuration is:

- Start the associated CIMPLICITY HMI project.
- Start the Modbus RTU Slave resident process.

Starting the Associated CIMPLICITY HMI Project

You need to start the associated CIMPLICITY HMI project in order to start the Modbus RTU Slave Interface.

To start the associated CIMPLICITY HMI project:

1. Open the associated project in the CIMPLICITY HMI Workbench.
2. Either:

   Method 1

   A. Click Project on the Workbench menu bar.

   B. Select Run.

   Method 2

   Click the **Run** button on the Workbench toolbar.
3. Check the list of started resident processes for the name **MRTUSI_RP**.

Modbus RTU Slave Troubleshooting

There are several diagnostic tools available to the user. These tools are particularly valuable if runtime behavior deviates from expected behavior. They can help isolate and troubleshoot the erroneous or erratic behavior of a working system.

Diagnostic tools include the following:

- CIMPLICITY HMI Status Log
- Protocol Stack Trace Log
- Modbus Exception Codes
- Test Program

Expected Modbus RTU Slave Runtime Behavior

This section describes the expected behavior of the Modbus RTU Slave Interface. This description provides the user with a reference point for using the diagnostic tools.

Data Address Space

The Modbus RTU Slave Interface maintains a data address space that mimics one or more PLCs and their associated coils and/or registers.

The user configuration will implicitly define the limits of valid data addresses for each unique combination of memory type and slave address. The minimum data address for any given memory type is 0 (zero-based). The maximum data address for a given memory type is the highest data address specified in the configuration. For example, if the highest holding register in slave address 1 is 40150 (one-based), then the maximum data address for memory type 4X is 149 (zero-based).

Guidelines. All data addresses in the address space are set to binary 0 on startup. If a data address is not mapped to a CIMPLICITY HMI point, then the following rules apply:

1. If the data address is a read-write address (memory type 0X or 4X), then a Modbus master may update (or read) the data address value. Thus, the data address may act as a memory store.
2. If the data address is a read-only address (memory type 1X or 3X), then a Modbus master may only read the data address. Thus, the data address value is always binary zero (0).

Modbus master data address references outside the configured range (i.e. greater than the highest user-specified data address for a given memory type and slave address) shall generate an exception response. *See the section "Using Modbus Exception Codes" in this chapter for more information.*

Data Types

The Modbus RTU Slave Interface supports mapping of all non-text (i.e. analog or Boolean) CIMPLICITY HMI points to Modbus data addresses. Non-array points are mapped to a single data address as specified in the register mapping definition. Array points and bitstring points are mapped to multiple consecutive data addresses, with the first element mapped to the register specified in the register mapping definition.

Data Flow

To maintain the current value of each mapped CIMPLICITY HMI point within the data address space, the Modbus RTU Slave Interface will accept unsolicited updates (from CIMPLICITY) for all mapped points. Thus, the Modbus master may read values from CIMPLICITY HMI points mapped to any supported memory type (0X, 1X, 3X, and 4X).

However, the Modbus RTU Slave Interface will only attempt to write to CIMPLICITY HMI points that are mapped to data addresses of memory type 0X or 4X. Thus, the Modbus master may write values to CIMPLICITY HMI points mapped to data addresses of memory type 0X or 4X.

Note that for a Modbus master write request to succeed, all data addresses specified must be valid and all corresponding values must be written successfully to PTMAP.

Data Coercion

The Modbus RTU Slave Interface performs run-time coercion for all data types.

Discrete data types are coerced according to the following guidelines.

Memory Type	Data Source	Source Value	Target Value
0X	CIMPLICITY HMI	zero (0)	0
	CIMPLICITY HMI	non-zero (!= 0)	1
	Modbus master	0	0
	Modbus master	0xFF or 0x01 (depends on function code)	1
1X	CIMPLICITY HMI	zero (0)	0
	CIMPLICITY HMI	non-zero (!= 0)	1

Guidelines. Analog data types are coerced according to the following guidelines.

1. For analog points with engineering units, the Modbus RTU Slave Interface will use the engineering unit value when converting to/from Modbus data values.
2. For analog points without engineering units, the Modbus RTU Slave Interface will transfer the raw value.
3. CIMPLICITY HMI point values will be coerced to two byte unsigned integer values. Thus, the fractional portion of real values will be lost.
4. The Modbus RTU Slave Interface will reject any CIMPLICITY HMI point value outside of the range defined by the Modbus Register Limits. *See the section "Modbus Register Limits Record" in this chapter to define these limits.*

Write Response Time

For a given Modbus master write request, the Modbus RTU Slave Interface will wait for all set point requests to complete before returning a response to the Modbus master. Since the set point requests are non-deterministic, no response time can be guaranteed for a write request. The Modbus master should be prepared to adjust its timeout parameter accordingly.

Dynamic CIMPLICITY HMI Configuration Changes

CIMPLICITY HMI supports reconfiguration of point properties while the project is running. The point properties that directly impact the behavior of the Modbus RTU Slave Interface include the following:

- Access rights
- Data type
- Array size

The Modbus RTU Slave Interface monitors the project database for changes in point properties. Once notified, point property changes are applied immediately.

Example

Changing the access rights for a point from read-write to read-only will cause Modbus write requests (that specify the corresponding data address) to fail.

In particular, changes to the array size of a point may have unexpected results. At startup, the Modbus RTU Slave Interface determines the array size for every mapped point. By definition, a scalar point has an array size of 1. In combination with other tests, the Modbus RTU Slave Interface uses the array size to ensure that every array element is mapped to a unique Modbus data address. The array size determined at startup becomes the maximum size allowed. Thus, while the array size may be reduced, the Modbus RTU Slave Interface ignores increases.

Using the CIMPLICITY HMI Status Log

If an error is detected, the Modbus RTU Slave interface logs:

- Error messages on startup.
- Informational warning and error messages at runtime.

Modbus RTU Slave Interface Startup Error Messages

On startup, the Modbus RTU Slave Interface validates the contents of the configuration file. *See the section "Modbus RTU Slave Configuration Overview" in this chapter for creating and editing the configuration file.* If an error is detected, an error message is logged. These error messages include the following:

Message	Cause / Resolution
Error opening configuration file (see next message).	The configuration file could not be opened. The following message provides more details. Ensure that a valid configuration file exists in the required directory. *See the section "Understanding the File Naming Convention" in this chapter.* Ensure that another application is not currently using the file.
Error reading from configuration file.	The configuration file could not be read. Check the file for invalid control characters. If necessary, replace the file with a backup copy, or rebuild the file using the provided template.
Configuration file contains more than one communication parameters record.	Ensure that the configuration file contains only one record with the prefix "CP".

Configuration file does not contain any communication parameters record.	The configuration file must contain a record with the prefix "CP".
Configuration file contains more than one trace log parameters record.	Ensure that the configuration file contains only one record with the prefix "TF".
Configuration file contains more than one Modbus register limits record.	Ensure that the configuration file contains only one record with the prefix "RL".
Configuration file does not contain any register mapping record.	The configuration file must contain at least one register mapping record (prefix "RM").
Configuration file contains the following invalid record (see next message).	Detected a record that is not a comment nor a blank line nor a valid definition. The following message contains the record. Ensure that the record starts with a valid record prefix or a valid comment character.
<record type> record is invalid.	For the given type of record, some or all of the required fields are missing, or are not properly delimited.
<record type> record contains an invalid <field name> field.	For the given type of record, the given field is not defined or contains invalid characters.
<record type> record specifies an invalid <field name>.	For the given type of record, the given field specifies an invalid parameter value (for example, the value is out of range).
Modbus register limits record specifies an invalid pair of limits.	The low register limit equals or exceeds the high register limit.
Duplicate register reference detected (see next two messages).	Detected two register mapping records that specify the same Modbus data address (slave address and register reference). The next two messages give the register mapping parameters (and array size) of the current and duplicate records. If the two records do not specify the same Modbus data address, check the array size of the CIMPLICITY HMI point specified in the Duplicate register mapping and ensure that sufficient data addresses are reserved.
Duplicate point identifier detected (see next two messages).	Detected two register-mapping records that specify the same CIMPLICITY HMI point. The next two messages give the register mapping parameters (and array size) of the current and duplicate records.
Unsupported data type for point: <point id>.	The data type of the given CIMPLICITY HMI point is not supported. *See the section "CIMPLICITY HMI Specifications for Modbus RTU Slave " in this chapter.*

Modbus RTU Slave Interface Runtime Error Messages

The Modbus RTU Slave Interface logs informational, warning, and error messages to the CIMPLICITY HMI project status log. These messages include the following:

Message	Cause / Resolution
Program startup completed successfully	Informational message - no action required.
Program shutdown completed successfully	Informational message - no action required.
Memory allocation error	Error creating an internal data structure. Increase available memory by stopping non-essential applications.
Error opening communication port channel: x.	Error occurred while connecting to the given COM port. Ensure that the given COM port is valid.
Error coercing Modbus value to CIMPLICITY point value (see next message).	The value of the given CIMPLICITY HMI point cannot be converted to the mapped Modbus memory type. Ensure that the value is within the Modbus Register Limits. *See the section "Modbus Register Limits Record" in this chapter.* Ensure that the data type is supported. *See the section "CIMPLICITY HMI Specifications for Modbus RTU Slave" in this chapter.*
On-change response coercion error for point: <point id>.	(see the previous message)

Important: The Modbus RTU Slave Interface also logs messages intended for use by GE Fanuc support personnel. If any of the following messages are logged, please contact your CIMPLICITY HMI vendor for support.

- Error initializing protocol layer object: xxx.
- Error registering slave addresses in protocol layer object: xxx
- Thread creation failed.
- Error occurred while waiting for thread to exit.
- Event object creation failed.
- Error occurred while setting event object.
- Failed to allocate an event flag from PTMAP subsystem.
- Error occurred while waiting for a response from the PIL worker thread.
- An invalid PTMAP response message was received. Response ignored.
- Invalid register count: xxx.
- Duplicate entry detected for slave address xxx, register class xxx.

Using the Protocol Stack Trace Log

The protocol stack trace log provides the user with an indication of the Modbus messages received and sent by the Modbus RTU Slave Interface at the communications port level. Each logged message is time stamped.

The user may enable or disable trace logging by defining a trace log parameters record within the Modbus RTU Slave Interface configuration file. *See the section "Trace Log Parameters Record" in this chapter.*

When enabled, the Modbus RTU Slave Interface writes protocol stack trace messages to the file **MRTUSI_RP.err** in the **log** sub-directory of the Project root directory.

Example

If the Project had been created in the directory **C:\CIMPLICITY\HMI\Projects\test**, then the trace message file specification is **C:\CIMPLICITY\HMI\Projects\test\log\MRTUSI_rp.err**.

The following is an excerpt from an actual trace log file.

```
2000-10-09 09:56:19.511 <- 0103 00000018 45c0
2000-10-09 09:56:19.611 -> 0101
3000010002000300040005000600070008000900 0A000B000C000D000E000F001000110012001300140015001600170018 5EAF
2000-10-09 09:56:19.641 <- 0103 00180018 C5C7
2000-10-09 09:56:19.701 -> 0103
300019001A001B001C001D001E001F00200021002200230024002500260027002800290 02A002B002C002E002F0030 8969
2000-10-09 09:56:19.741 <- 0103 00300018 45CF
2000-10-09 09:56:19.802 -> 0103
300031003200330034003500360037003800390 03A003B003C003D003E003F004000410042004300440045004600470048 036D
2000-10-09 09:56:19.842 <- 0103 00480018 C5D6
2000-10-09 09:56:19.922 -> O1O3
300049004A004B004C004D004E004F005000510052005300540055005600570058005900 5A005B005C005D005E005F0060 D84A
2000-10-09 09:56:20.012 <- 0103 00600004 4417
2000-10-09 09:56:20.102 -> 0103 080061006200630064 ED2C
2000-10-09 09:56:35.464 <- 8002 000000C8 678D
2000-10-09 09:56:35.554 -> 8002
19555555555555555555555555555555555555555555555555555555555555 60E3
```

The format for a trace log message is:

<*date*> <*time*> <*direction*> <*slave address*><*function code*> <*data*> <*CRC*>

Where:

<*date*> is \the date the message was received or sent.

<*time*> is the time the message was received or sent.

<*direction*> is an arrow indicating whether the message is a request or response message.

Request (left arrow): **<-**

Response (right arrow): **->**

Note: the remaining fields are displayed as hex values (two characters per byte).

<*slave address*> is the emulated slave device address.

<*function code*> is one byte representing the requested operation. If an exception response is generated, the high bit is set.

<*data*> is one or more bytes containing function parameters, data values, and/or exception code.

<*CRC*> is trailing two bytes containing the cyclical redundancy check value.

Using Modbus Exception Codes

The user may diagnose errors by examining response messages returned by the Modbus RTU Slave Interface to the Modbus master. Certain conditions will cause the Modbus RTU Slave Interface to return exception responses. This section documents the supported Modbus exception codes and their possible causes.

Exception Code	Cause
0x01 (Illegal Function)	Modbus request specifies an unsupported function code. *See the section "Function Codes Supported by Modbus RTU Slave " in this chapter for a list of functions supported by the Modbus RTU Slave Interface.*
0x02 (Illegal Data Address)	Modbus request specifies an invalid data address, or specified a data address range that extends beyond the highest configured data address.
0x03 (Illegal Data Value)	Modbus write request specifies an analog data value that exceeds the data type range or the configured EU limits of the associated CIMPLICITY HMI Point.
0x04 (Slave Device Failure)	Modbus write request specifies a data address mapped to a disabled, unavailable, or read-only CIMPLICITY HMI Point.

The format for a Modbus exception response message is:

<*slave address*><*function code*><*exception*><*CRC*>

Where

<*slave address*> is the emulated slave device address.

<*function code*>is one byte representing the failed operation. Note that the high bit is set.

<*exception*> is one byte representing the exception code. See table above.

<*CRC*> is trailing two bytes containing the cyclical redundancy check value.

Modbus RTU Slave Test Program

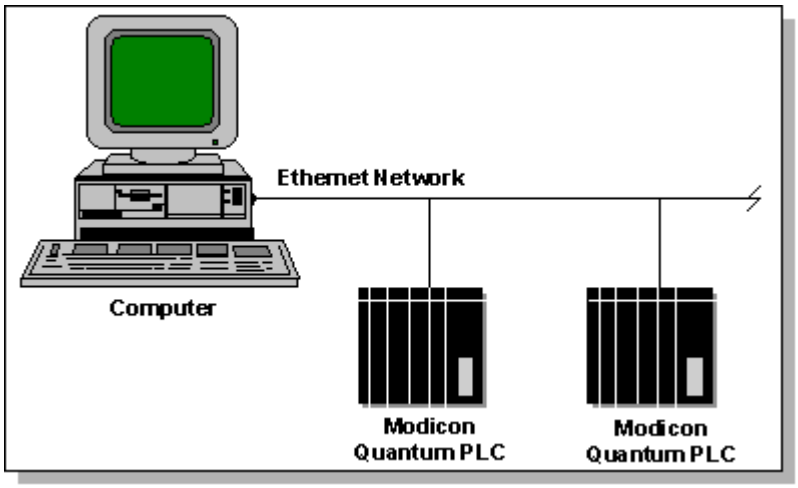
CIMPLICITY HMI provides a sample Modbus master test program. The test program generates Modbus requests and displays the received responses. To test communications with the Modbus RTU Slave Interface, two serial ports are required - one port for the test program, and the other port for the Modbus RTU Slave Interface.

For more information regarding the test program, refer to the CIMPLICITY HMI Device Communications Manual (GFK1181G), Modbus RTU Communications, Validating Modbus RTU Communications.

Modbus TCP/IP Communications

About Modbus TCP/IP Communications

The Modbus TCP/IP Communications option supports communication with Modbus Quantum programmable controllers using the TCP/IP protocol over an Ethernet network.



This enabler supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Unsolicited data
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Supported Modbus TCP/IP Devices

The Modbus TCP/IP communications enabler supports Modicon Quantum PLCs. The following Ethernet TCP/IP interface card is required in the Modicon Quantum PLCs:

NOE 211 00

The following types of data collection are supported:

Solicited Data	Devices may be accessed directly from an Ethernet network.
Unsolicited Data	Unsolicited data collection is supported for devices connected directly to Ethernet network.

Supported Modbus TCP/IP Memory Types

Data may be read from the following memory types:

Coils

Discrete Inputs

Input Registers

Holding Registers

General Reference

Holding Registers as Double Precision

Data may be written to the following memory types:

Coils

Holding Registers

General Reference

Holding Registers as Double Precision

Double Precision Notes

D4xxxx(x) points are Holding Register Points interpreted as Double Precision. Two registers are used for each point with both registers are assumed to have a positive value.

Because of this mapping:

- Do not declare Double Precision points with overlapping addresses. For example, D40001 and D40002 overlap, while D40001 and D40003 do not.
- Do not define points that use the same Holding Register and Double Precision point address (for example, defining one point with the address D40001 and another with the address 40001).

Configure Double Precision points as **DINT** or **UDINT** point.

Arrays are not supported for Double Precision points.

Modbus TCP/IP Required Documents

You should have the following document available when configuring devices for Modbus TCP/IP Communications:

***Modicon Quantum Ethernet TCP/IP Module User Guide* (840 USE 107 00)**

In addition, if you are planning to send unsolicited data from a Modbus Ethernet controller, you should have the following document available:

***Modicon Ladder Logic Block Library User Guide* (840 USE 101 00)**

Modbus TCP/IP Installation Checklist

Prior to going through this checklist, install the CIMPLICITY HMI base system software and the Modbus TCP/IP Communications option.

1. Use the *Modbus TCP/IP Diagnostics* function to test communications with programmable controllers on the network.
2. Use the *Ports* function to create port information.
3. Use the *Devices* function to configure one CIMPLICITY device for each programmable controller from which data will be collected.
4. Use the *Device Points* function to configure points for the devices on the Modbus TCP/IP network.

Modbus TCP/IP Installation Verification

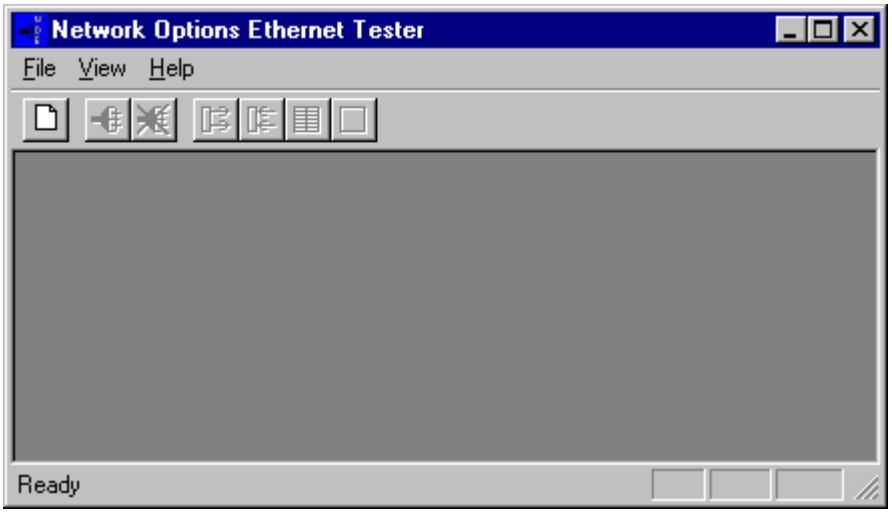
You can use the Modbus TCP/IP Diagnostics program provided with the CIMPLICITY HMI Modbus TCP/IP Communications option to check the basic configuration and operation of your network without starting a CIMPLICITY HMI project. You can perform the following functions:

- Read Holding Registers
- Write Holding Registers

For this program to function, you must have successfully installed the CIMPLICITY HMI Modbus TCP/IP Communications option.

To start the program, select the *Modbus TCP/IP Diagnostics* icon in the CIMPLICITY HMI menu.

The *Network Options Ethernet Tester* window opens.



This menu monitors data communications for a given Modicon Quantum PLC.

The following sections discuss some of the more frequently used functions of the tester utility. For more detailed information about using this utility, please refer to ***Modicon Quantum Ethernet TCP/IP Module User Guide*** **(840 USE 107 00)**.

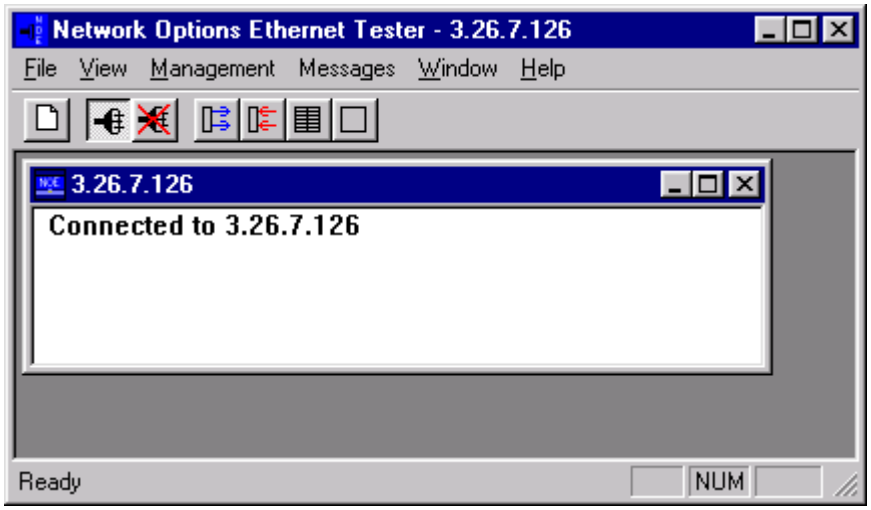
Connecting to a PLC

To connect to a Modicon Quantum programmable controller:

1. Select **New** from the **File** menu or click the **New** button on the Toolbar. The Remote IP Address dialog box opens.

2. Enter the IP address of the Modicon Quantum PLC in the **IP Address** field.
3. Click **OK**.

The window looks like this when the connection is made:



Configuration of a Destination ID

When a bridge is used, the user is required to include a destination ID in the device address.

The format of the device address is **X.X.X.X@Y**

Where

X.X.X.X is the Modicon Bridge IP address and

Y is the Destination ID of the device to route the message to.

Example

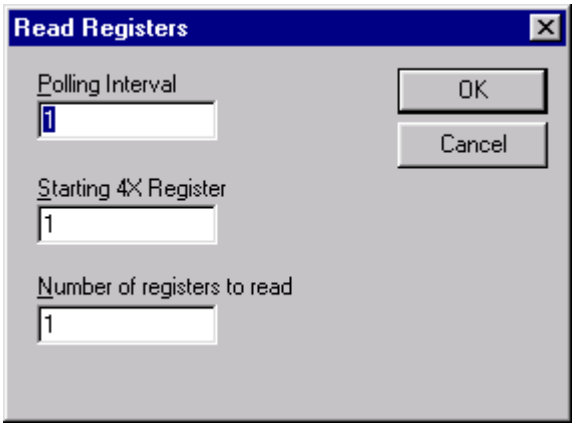
To communicate with a device mapped to Destination ID 5, through a bridge with IP address 1.2.3.4, the device address should be 1.2.3.4@5.

Reading Modbus TCP/IP Test Data

To initiate a read request from the device, select the device's window and do one of the following:

- Select **Read Registers** from the **Messages** menu.
- Click the **Read Registers** button on the toolbar.

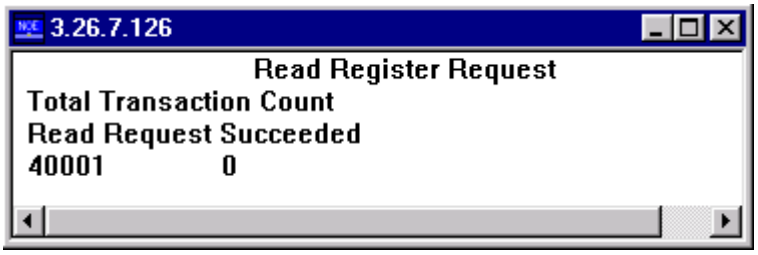
The Read Registers dialog box opens.



To specify the request:

1. Enter the polling interval in the **Polling Interval** field.
2. Enter the starting Holding Registers memory address where you want to read data in the **Starting 4X Register** field.
3. Enter the number of registers to read in the **Number of registers to read** field.
4. Select **OK**.

When the request completes, the window for the device looks like this:

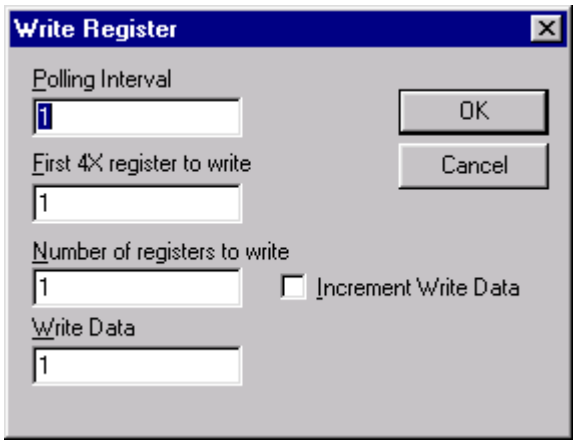


Writing Modbus TCP/IP Test Data

To initiate a write request from the device, select the device's window and do one of the following:

- Select **Write Registers** from the **Messages** menu.
- Click the **Write Registers** button on the toolbar.

The *Write Register* dialog box opens.



To specify the request:

1. Enter the polling interval in the **Polling Interval** field.
2. Enter the starting Holding Registers memory address where you want to write data in the **Starting 4X Register** field.
3. Enter the number of registers to write in the **Number of registers to write** field.
4. Enter the data you want written to the registers in the **Write Data** field.
5. Select **OK**.

Showing Device Statistics

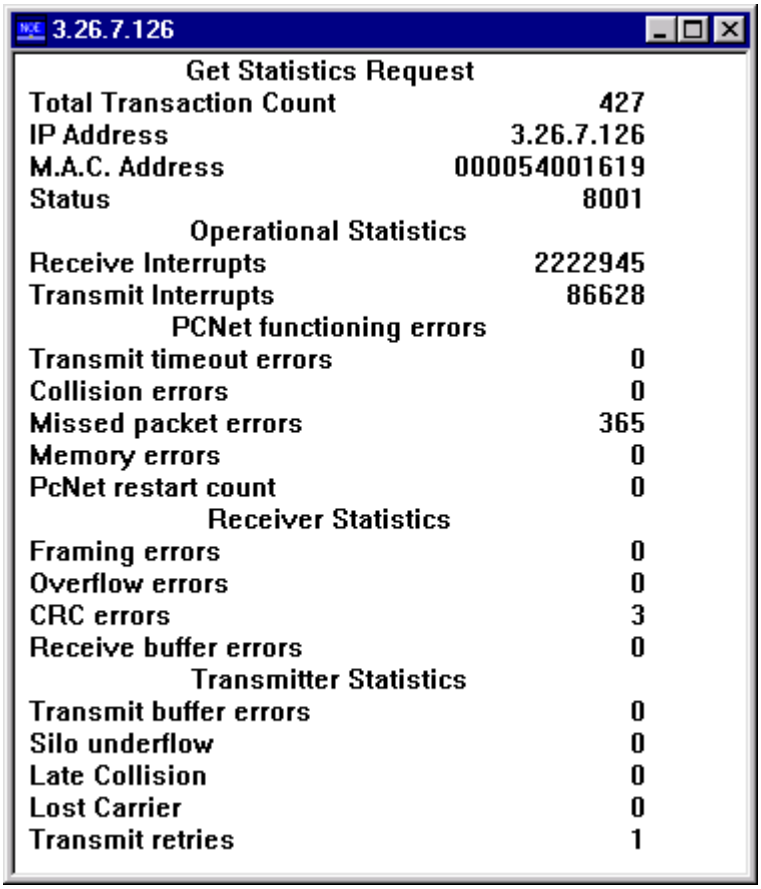
To display communication statistics for a device, select the device's window and do one of the following:

- Select **Get Stats** from the **Messages** menu.
- Click the **Get Stats** button on the toolbar.

The *Get Statistics* dialog box opens.

Enter the polling interval you want in the **Polling Interval** field, and select **OK**.

The device's window displays the following information:



Clearing Device Statistics

To clear communication statistics for a device, select the device's window and do one of the following:

- Select **Clear Stats** from the **Messages** menu.
- Click the **Clear Stats** button on the toolbar.

The *Clear Statistics* dialog box opens.

Enter the polling interval you want in the **Polling Interval** field, and select **OK**.

Modbus TCP/IP Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to Modbus TCP/IP communications.

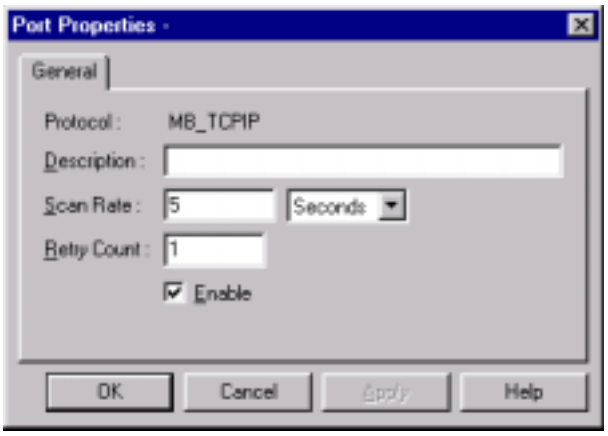
Modbus TCP/IP Port Configuration

When you create a new port for Modbus TCP/IP communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **MB_TCPIP** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for Modbus TCP/IP communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

General Port Properties



Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates are multiples of the base rate. You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.
Retry Count	If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it. Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.
Enable	Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Modbus TCP/IP Device Configuration

When you create a new device for Modbus TCP/IP communications, enter the following information in the *New Device* dialog box:

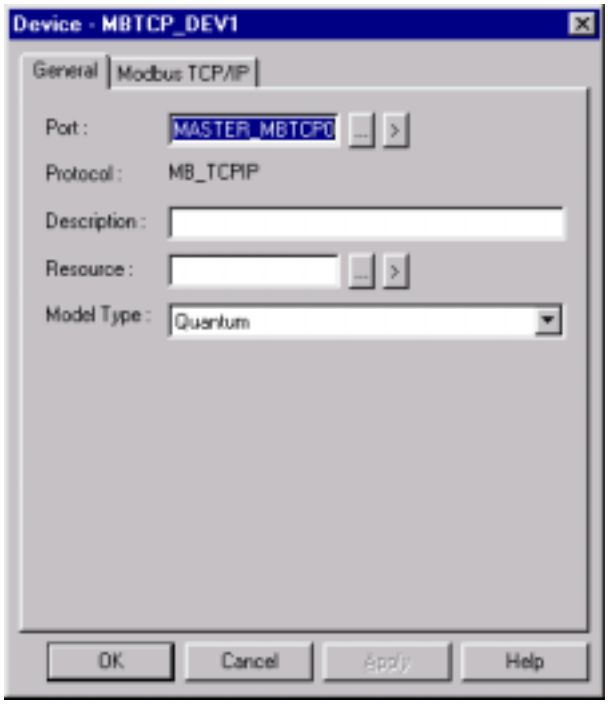
1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Modbus TCP/IP port to be used by the device.

When you select **OK** to create the device, the *Device Properties* dialog box opens.

Important

Only one CIMPLICITY HMI device can be configured per physical Modicon programmable controller. Modbus TCP/IP communications will not run with multiple CIMPLICITY HMI devices configured for the same programmable controller.

General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

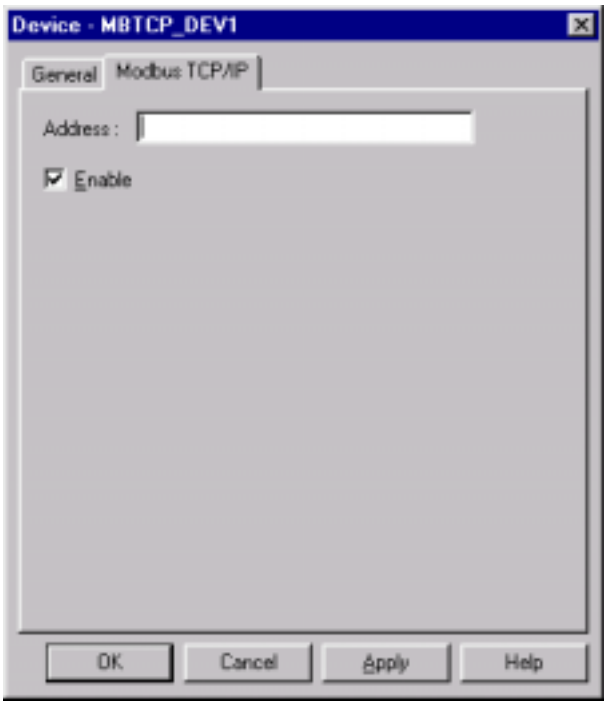
Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button - - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, and make a selection. For this protocol, the only choice is:

Quantum

Modbus TCP/IP Properties



Use the *Modbus TCP/IP* properties to enter information about Modbus TCP/IP communications for the device. You can define the following:

Address Enter the unique Modbus TCP/IP IP address for the device.

Any CIMPLICITY HMI devices that use the same Modbus TCP/IP address should not be enabled at the same time.

This does not apply when a destination ID is used.

Enable Set this check box to enable the device when the project starts. If you clear this check box, the device will not be enabled and points associated with the device will be unavailable.

Modbus TCP/IP Point Configuration

Once your devices are configured, you may configure points for them. Through device point configuration, you may configure the following:

- Points that read or set Coils.
- Points that read Discrete Inputs.
- Points that read Input Registers.
- Points that read or set Holding Registers.
- Points that read or set General Reference
- Points that read Holding Registers as Double Registers

The fields described below have configuration values that are unique to or have special meaning for Modbus TCP/IP communications.

General Tab in the Point Properties Dialog Box

On the General tab, the type of **Access** you choose depends on the point address:

- Select **Read** for points from Discrete Inputs or Input Registers.
- Select **Read/Write** for points from Coils, Holding Registers, General Reference or Double Precision.

Device Tab in the Point Properties Dialog Box

On the Device tab:

Update Criteria

The update criteria you use determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by the Modbus TCP/IP driver at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by the Modbus TCP/IP driver at regular intervals while users are viewing them.

Select **Unsolicited** for points whose value will be sent by the programmable controller as necessary.

Important

The address of the unsolicited data *must* exactly match the point address.

Address

Enter the point address of the data as follows:

0xxxx or **0xxxxx** for Coils
1xxxx or **1xxxxx** for Discrete Inputs
3xxxx or **3xxxxx** for Input Registers
4xxxx or **4xxxxx** for Holding Registers
6yxxxx or **6yxxxxx** for General Reference
D4xxxx or **D4xxxxx** for Holding Registers as Double Precision

where **xxxx** or **xxxxx** is the bit number or register number of the point. For example, the address of Holding Register 1 is 40001, and the address of Coil 1 is 00001.

If you are configuring a General Reference point, **y** is the file number.

Double Precision points in Holding Registers require two Holding Registers per point. The upper register is multiplied by 10000 and the product is added to the lower register to get the resulting value. No more than one Double Precision point may be written in a single write operation. Use **DINT** or **UDINT** types for these points.

If you are configuring an Analog point type in Discrete Inputs or Coils, the address entered in this field must be that of the least significant bit of the point. For example, if you configure 16-bit analog point for Coils 17 through 32, enter 00017 in this field.

When you configure Boolean points in Holding Registers, Input Registers or General Reference, you must also enter data in the following field:

Bit Offset

Enter the bit offset in the Holding Register or Input Register or General Reference that defines the point, where 0 is the least significant bit and 15 is the most significant bit.

Modbus TCP/IP Unsolicited Data

To send unsolicited point values from a Modbus TCP/IP programmable controller to the CIMPLICITY HMI project using the Modbus TCP/IP Communication enabler, a MSTR function block must be coded in the ladder logic. The MSTR block can send a request to write to Holding Registers in another Modbus TCP/IP slave. The Modbus TCP/IP Communication enabler uses the data portion of this message to hold a command to set a CIMPLICITY HMI point value.

The Modbus TCP/IP Communications enabler can receive unsolicited values for points in all four device memory types (Coils, Discrete Inputs, Input Registers, and Holding Registers).

CIMPLICITY HMI device points with the following criteria will be updated with values from the command:

- The starting address of the point exactly matches the address in [Word 3] of the command,
- The length of the point is less than or equal to the number of data bytes sent (as specified in [Word 4] of the command),
- The point's Modbus TCP/IP device address matches that of the device sending the command

Note

You can find information on ladder logic programming and the MSTR block function in ***Modicon Ladder Logic Block Library User Guide*** **(840 USE 101 00**).

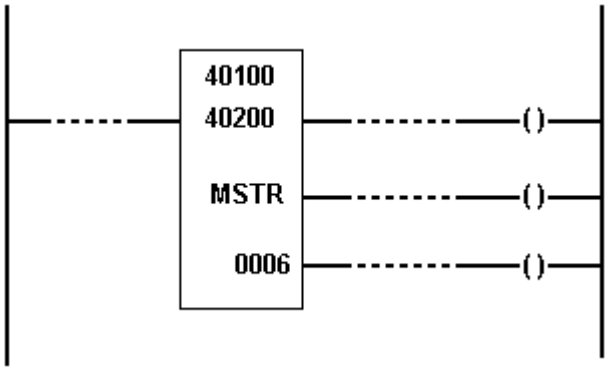
MSTR Block Data Area Format

The format of the MSTR block data area is:

Word 0	One
Word 1	Zero
Word 2	Zero
Word 3	Address of the point to be updated. Valid values are: 1 - 8192 for Coils 10001 - 18192 for Discrete Inputs 3001 - 39999 for Input Registers 4001 - 49999 for Holding Registers
Word 4	Number of bytes of point data being sent. Valid values are 1-190.
Word 5 through **Word 99**	Point data

Sample MSTR Block

The diagram below summarizes the use of the MSTR block to send unsolicited data to the CIMPLICITY HMI Modbus TCP/IP communication enabler from a device.



In this example:

- The Control Block, found in Holding Registers 40100 through 40108, contains control information for the MSTR block. These indicate that six registers worth of data will be sent to the device at Modbus TCP/IP address 3.26.5.42 and stored starting at address 40001.

  The CIMPLICITY HMI Modbus TCP/IP Communication enabler does not use address information configured in the control block. Instead, it interprets the data area as a command.

- The Data Block, found in Holding Registers 40200 through 40205, contains a command to the CIMPLICITY HMI Modbus TCP/IP Communication enabler to set the value of a point at Input Register 17 to a value of 21035.

Control Block

The Control Block used to send the sample data is stored in Holding Registers 40100 through 40108. Values stored in the Control block are:

	Register	Example
Write Command	40100	1
Status Word	40101	xxxxx
Number of registers to send	40102	6
Destination HR in Slave device	40103	40001
Quantum backplane slot address of the network adapter module (high byte)	40104	768
First byte of IP address	40105	3
Second byte of IP address	40106	26
Third byte of IP address	40107	5
Forth byte of IP address	40108	42

These Holding Registers indicate that six registers worth of data will be sent to the device at Modbus TCP/IP address 3.26.5.42 and stored starting at address 40001. The Quantum backplane slot address of the network adapter module is 3. To put it in the high order byte, multiply the slot address by 256 (3*256 = 768).

Data Block

The Data Block used to send the sample data is stored in Holding Registers 40200 through 40205. The sample data being sent is:

	Register	Example
Network address of sending PLC	40200	1
	40201	0
	40202	0
Address of point receiving unsolicited data	40203	30017
Number of bytes of data	40204	2
The unsolicited value	40205	21035

This command causes the Modbus TCP/IP communications enabler to set the point with the address of Input Register 17 to a value of 21035.

The network address of the sending PLC is *not* used currently.

Advanced Modbus TCP/IP Configuration Topics

Alternate Configuration Files

The Modbus TCP/IP device communication enabler is designed to operate with devices compatible with the Open Modbus/TCP specification release 1.0. Because the Modbus TCP/IP protocol is supported by a number of vendors on a variety of different devices and because the layout of memory varies from device to device, the range of the various defined memory types varies.

As part of its initialization, the device communication enabler determines the size of the various memory types. By default, the size of the memory is determined by probing the device to determine the range of memory.

This method may not be appropriate for all devices. For devices that have any of the following characteristics, the alternate configuration file described below should be used:

- Devices with non-consecutive memory. (All configured device points must be correctly configured to maintain reliable communication.)
- Devices that do not support the protocol for reading multiple quantities of consecutive memory locations for ***all*** of the following (independent of point configuration):
  - ➔ Coils
  - ➔ Discrete Inputs
  - ➔ Discrete Outputs
  - ➔ Holding Registers
  - ➔ General Reference Registers
  - ➔ Double Precision Input Registers
  - ➔ Double Precision Holding Registers
- Environments that are either noisy or busy such that a retry count greater than 5 is required in order to reliably maintain communication with the device.

Entering Model Information

Each device included in the project that will be using the alternate configuration must have a STAT_PLC model.

If the STAT_PLC model is not a selectable from the device configuration screen, it can be added to the CIMPLICITY configuration by editing the IC646TME000.MODEL configuration file located in the BSM_DATA subdirectory of the original CIMPLICITY distribution. Using a text editor, add the following line to the file:

```
MB_TCPIP|STAT_PLC|35
```

For existing projects, these additional steps define a process for adding the model:

1. Set default directory to the master sub-directory of the project.
2. **`Idtpop model`**
3. Using a text editor, add the following line to the file:

   `MB_TCPIP|STAT_PLC|35`
4. Save and exit from the text editor.
5. **`Scpop model`**
6. Update the project.

Entering Required Configuration Data

For each device port in the project, a separate alternate configuration file must be created. The alternate configuration file must be located in the **data** subdirectory for each project.

For each alternate configuration file, the file name is based on the port configuration. For the first port, the file name is MASTER_MBTCP0.INI. This file would contain any devices configured on the first port that use the alternative configuration. The MASTER_MBTCP1.INI would contain the alternate configuration information for devices configured on the second port. The same convention is followed for devices configured for use on the other Modbus Ethernet ports.

In the alternate configuration file, for each device using this scheme, the following information is required:

1. CIMPLICITY device name
2. Number of bytes used for each of the following memory references:
   - Coils (**`COILS`**)
   - Discrete Inputs (**`DISC INPUTS`**)
   - Input Registers (**`INPUT REG`**)
   - Holding Registers (**`HOLDING REG)`**
   - General Reference File 1 (**`GEN REF FILE1`**)
   - General Reference File 2 (**`GEN REF FILE2`**)
   - General Reference File 3 (**`GEN REF FILE3`**)
   - General Reference File 4 (**`GEN REF FILE4`**)
   - General Reference File 5 (**`GEN REF FILE5`**)
   - General Reference File 6 (**`GEN REF FILE6`**)
   - General Reference File 7 (**`GEN REF FILE7`**)
   - General Reference File 8 (**`GEN REF FILE8`**)
   - General Reference File 9 (**`GEN REF FILE9`**)
   - General Reference File 10 (**`GEN REF FILE10`**)
   - Double Precision Input Registers (**`DP_INPUT REG`**)
   - Double Precision Holding Registers (**`DP_HOLDING REG)`**

For example, if there are 16384 coils on the device, the coil byte count in the configuration file would be 2048 (8 coils per byte). Similarly, if there are 32767 holding registers on the device, the byte count of holding registers in the configuration file would be 65534 (2 bytes per holding register).

Sample Alternate Configuration File

The sample configuration file in this section defines the domain configuration for two devices, DEVICE1 and DEVICE2. Note that each Device ID appears as a section heading inside square brackets.

Also notice the **UseTheseDomainSizes** variable is set to 1. This variable must appear in each device section. If this variable is set to 0, or if there is no section heading for a device on this port, or if this **.ini** file does not exist, the Modbus TCP/IP devcom will auto-size the domains as it always has.

There are 16 domains in a Modbus TCP/IP device. In the example below, you will see each domain's name followed by the default size of that domain. If a domain name is not provided within a device section, the default size is assigned.

The format of the alternate configuration file is shown below:

```
[DEVICE1]
UseTheseDomainSizes=1
COILS=65535
DISC INPUTS=65535
INPUT REG.=65535
HOLDING REG.=65535
GEN REF FILE1=0
GEN REF FILE2=0
GEN REF FILE3=0
GEN REF FILE4=0
GEN REF FILE5=0
GEN REF FILE6=0
GEN REF FILE7=0
GEN REF FILE8=0
GEN REF FILE9=0
GEN REF FILE10=0
DP_INPUT REG.=0
DP_HOLDING REG.=0

[DEVICE2]
UseTheseDomainSizes=1
COILS=65535
DISC INPUTS=65535
INPUT REG.=65535
HOLDING REG.=65535
GEN REF FILE1=0
GEN REF FILE2=0
GEN REF FILE3=0
GEN REF FILE4=0
GEN REF FILE5=0
GEN REF FILE6=0
GEN REF FILE7=0
GEN REF FILE8=0
GEN REF FILE9=0
GEN REF FILE10=0
DP_INPUT REG.=0
DP_HOLDING REG.=0
```

Maintaining Files

Important: When the alternate configuration file is used, it is essential that the information in the file be maintained so that it always accurately reflects the configuration of the actual device.

If the file defines a memory type that is too small and there are device points referencing memory locations beyond the range declared in the configuration file, but defined on the device, the point will be incorrectly declared invalid.

If the file defines a memory range that is too large, the result can be an intermittent loss of device communications where the root cause cannot be found based on environmental causes. This will occur if a device point is defined with a reference that is beyond the device memory of the device, but within the range defined in the configuration file.

Modbus TCP/IP Global Parameters

If you are using the Modbus TCP/IP protocol on a computer where you will also be running the Modbus TCP/IP Slave application option, you will need to add the following to the global parameters:

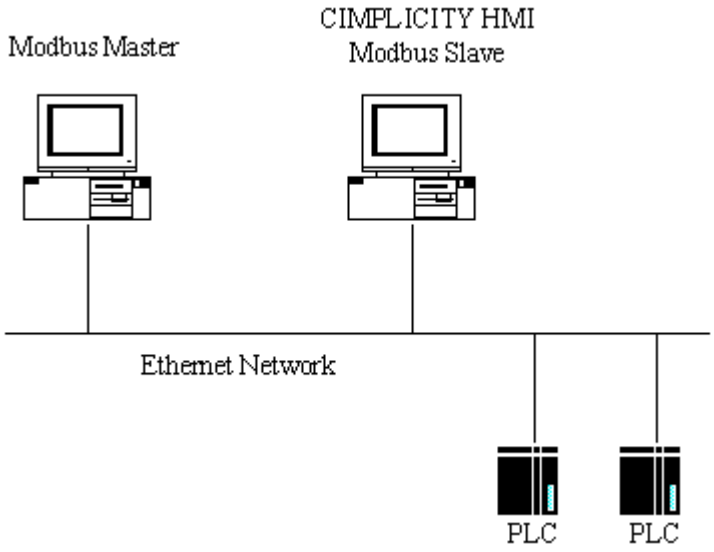
`MBETH_DISABLE_UNSO_DATA|1|Y`

This global parameter disables the use of the socket for the receipt of unsolicited data in the Modbus TCP/IP device communications.

Modbus TCP Slave Communications

Modbus TCP Slave Communications Overview

The Modbus TCP Slave Communications option supports a multi-drop configuration with the Modbus TCP Slave Communications enabler functioning as a slave. In effect, the Modbus TCP Slave Communications enabler presents the CIMPLICITY HMI Points as if they were data values from one or more Modbus TCP Slave devices.



The CIMPLICITY Points are mapped to Modbus Addresses, allowing a Modbus Master to obtain point values as if they were coils or registers on a Slave device.

SystemLink uses the Modbus TCP Slave feature to enable CIMPLICITY to collect point values over the Internet using the Modbus protocol. The node that is set up as the Master can collect data from the Slave nodes via the Internet.

Important: The Modbus TCP slave is *not* supported in a host redundant environment.

Modbus TCP Slave Specifications

CIMPLICITY HMI Specifications for Modbus TCP Slave

Supported Data Types

This communications option supports the following data types:

- Boolean
- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Arrays of the above data types

Modbus TCP Slave Protocol

Transmission Mode Supported by Modbus TCP Slave

The Modbus TCP Slave Communications option supports the RTU transmission mode.

Message Framing Supported by Modbus TCP Slave

The Modbus TCP Slave Communications option supports RTU framing. RTU framing implies the following communication parameters:

- Data bits: 8
- Start bits: 1
- Parity: Even, Odd, or None
- Stop bits: 1 or 2
- Error checking method: CRC

Modbus TCP Slave Device Emulation

The Modbus TCP Slave Communications option emulates one or more generic Modicon programmable controllers. Valid slave addresses: 0 to 128.

Memory Types Supported by Modbus TCP Slave

The Modbus TCP Slave Communications option emulates the Modbus memory types based on Modicon programmable controllers.

The Modbus TCP Communications option supports writes to the following memory types:

Memory Type	Reference Class	Description
Coils	0X	Discrete Outputs
Holding Registers	4X	Analog Outputs

The Modbus TCP Slave Communications option supports reads from the following memory types:

Memory Type	Reference Class	Description
Coils	0X	Discrete Outputs
Inputs	1X	Discrete Inputs
Input Registers	3X	Analog Inputs
Holding Registers	4X	Analog Outputs

Function Codes Supported by Modbus TCP Slave

The Modbus TCP Slave Communications option supports the Modbus function codes listed in the following table. As well, the maximum number of coils or registers that may be specified or included in a single Modbus message is also given.

Function Code	Description	Maximum # of coils / registers
1	Read Coil Status	2000
2	Read Input Status	2000
3	Read Holding Registers	125
4	Read Input Registers	125
5	Force Single Coil	1
6	Force Single Register	1
15 (0x0F)	Force Multiple Coils	800
16 (0x10)	Preset Multiple Registers	100

Required Documents

The Modbus TCP Slave Communications enabler adheres to the Modbus protocol specification as defined in the following document:

Modicon Modbus Protocol Reference Guide (PI-MBUS-300), Rev. J, June 1996

Procedure for Getting Modbus TCP Slave Started

The CIMPLICITY HMI Modbus TCP Slave Interface provides a way to access CIMPLICITY HMI points as Modbus coils and/or registers from Modbus master devices. This section guides a user through the steps to become familiar with the Modbus TCP Slave Interface application and to start using the application quickly.

The following getting started guide assumes that the Modbus TCP Slave Interface has been successfully installed and that at least one CIMPLICITY HMI project has been created.

Steps include:

Step 1. Identify CIMPLICITY HMI Points.

Step 2. Map points to Modbus data addresses.

Step 3. Select the Modbus TCP Slave protocol.

Step 4. Start the CIMPLICITY HMI project.

Step 5. Start the Modbus Master.

Step 6. Validate communications.

Step 1. Identify CIMPLICITY HMI Points

Identify the CIMPLICITY HMI points you wish to access from a Modbus master device. If necessary, create device or virtual points to receive values from a Modbus master device. Create virtual points to re-range analog point values to prevent data coercion errors, or to minimize loss of significance. For example, real values are truncated when transferred to a Modbus analog data address.

Step 2. Map Points to Modbus Data Addresses

Map (link) CIMPLICITY HMI points to Modbus data addresses by creating register-mapping definitions within the configuration file. *See the section "Register Mapping Records" in this chapter.*

To maximize throughput:

1. Map:
   - Boolean points to coil (0X) or input status (1X) data addresses.
   - Analog points to input register (3X) or holding register (4X) data addresses.

   Avoid gaps in allocated data addresses. *See the section "Using Register Mappings Guidelines" in this chapter for other tips.*
2. Edit the configuration file to specify the
   - Communications port parameters,
   - Trace log parameters, and
   - Modbus register limits.

   See the section "Reviewing Types of Modbus TCP Slave Configuration Records" for details.

Step 3. Select the Modbus TCP Slave Option

See the section "Step 2 of 3. Select the Modbus TCP Slave Protocol" to add the Modbus TCP Slave Interface to your CIMPLICITY HMI project.

Step 4. Start the CIMPLICITY HMI Project

You start the associated CIMPLICITY HMI project before you start the Modbus TCP Slave Interface.

To start the associated CIMPLICITY HMI project:

1. Load the project from the CIMPLICITY HMI Workbench application.
2. Either:
   A. Select Run from the Workbench Project pull-down menu, or
   B. Click the **Run** button on the Workbench toolbar.
3. Check the list of started resident processes for the name **`MTCPSI_RP`**.

Step 5. Start the Modbus Master

At this point, the Modbus TCP Slave Interface is ready to process Modbus Master requests. Start the Modbus Master device according to the documentation provided with the device.

Step 6. Validate Communications

CIMPLICITY HMI provides a number of diagnostic tools to validate communications between CIMPLICITY HMI and the Modbus master. For example, use the CIMPLICITY Point Control Panel to display dynamic changes to CIMPLICITY HMI points. *See the section "Modbus TCP Slave Troubleshooting" for details of other diagnostic tools.*

Modbus TCP Slave Configuration Overview

This section describes the configuration process for the Modbus TCP Slave Interface. To configure the Modbus TCP Slave Interface, follow these steps:

Step 1. Edit the configuration file.

Step 2. Select the Modbus TCP Slave protocol.

Step 3. Implement the Modbus TCP Slave configuration.

Step 1 of 3. Edit the Modbus TCP Slave Configuration File

When a new CIMPLICITY HMI project is created, a template configuration file is created for the Modbus TCP Slave Interface. The file has a comma-separated value (CSV) format similar to the format used by the CIMPLICITY HMI import/export utility.

Modify the configuration file to specify the:

- IP address parameters
- Trace log parameters
- Modbus register limits
- Point / register mappings.

Understanding the File Naming Convention

The Modbus TCP Slave Interface determines the file specification of the configuration file at startup by combining the file name **`MTCPSI_RP.CFG`** with the file path of the **`project\data`** directory.

Example

If the project has been created in the directory

```
C:\CIMPLICITY\HMI\Project\Data\
```

Then the configuration file specification is:

```
C:\CIMPLICITY\HMI\HMI\Project\data\MTCPSI_RP.cfg
```.

Reviewing Types of Modbus TCP Slave Configuration Records

The configuration file may contain the following types of records:

IP Address Parameters	Defines the IP address.
Trace Log Parameters	Specifies the state (on/off) of protocol stack diagnostics logging.
Modbus Register Limits	Defines the range of valid values for a Modbus analog register (memory type 3X or 4X).
Register Mapping	Defines a mapping between a CIMPLICITY HMI point and a Modbus data address.

Comments	Any line beginning with one or more pound signs (#). Ignored by the Modbus TCP Slave Interface.
Blank lines	Ignored by the Modbus TCP Slave Interface.

IP Address Parameters Record

The configuration file must contain a IP Address Parameters record. In addition, all fields must be present.

The format for the IP Address Parameters record is:

IP, 0.0.0.0	Picks up the first configured IP address.

IP <*address***>**

Where

IP	Identifies the record as an IP address object definition.
<*address*>	IP address in dotted-decimal notation.

Trace Log Parameters Record

The configuration file may contain a Trace Log Parameters record.

The format for the Trace Log Parameters record is:

TF,<*logging state*>

Where

TF	Identifies the record as a trace log parameters record.
<*logging state*>	Protocol stack logging state. Valid settings: On, Off. Default value: Off.

Note: If the Trace Log Parameters record is not defined, the protocol stack logging state is Off.

Trace log messages are written to the standard error file associated with the Modbus TCP Slave Interface process. *See the section "Using the Protocol Stack Trace Log" for more information.*

Modbus Register Limits Record

The configuration file may contain a Modbus Register Limits record. These limits are applied only to CIMPLICITY HMI points mapped to analog registers (register type 3X or 4X).

The format for the Modbus Register Limits record is:

RL,<*low limit*>,<*high limit*>

Where

RL	Identifies the record as a Modbus register limits record.
<*low limit*>	The minimum value accepted from a CIMPLICITY HMI point. Valid range of values: – 2147483648 to 2147483647. Must be less than <*high limit*>. Default value: – 2147483648.
<*high limit*>	The maximum value accepted from a CIMPLICITY HMI point. Valid range of values: – 2147483648 to 2147483647. Must be greater than <*low limit*>. Default value: 2147483647.

Note: If the Modbus Register Limits record is not defined the low and high limits are between – 2147483648 to 2147483647, respectively.

Register Mapping Records

The configuration file must contain one or more Register Mapping records. In each Register Mapping record, all fields must be present.

The format for the Register Mapping record is:

RM,<*slave*>,<*register*>,<*point id*>

Where

RM	Identifies the record as a register mapping record.
<*slave*>	The emulated slave device address. Valid range of values: 0 to 128.
<*register*>	One-based Modbus address including the memory type prefix. See the following table for valid range of values:

Memory Type	Address range
0x - Coils (Discrete)	1 to 9999
1x - Inputs (Discrete)	10001 to 19999
3x - Input Registers (Analog)	30001 to 39999
4x - Holding Registers (Analog)	40001 to 49999

<*point id*>	String that uniquely references a point in a CIMPLICITY HMI project. Must specify a non-text attribute (i.e. analog or Boolean).

Viewing a Sample Configuration File

The following is a sample configuration file specifying register mappings for two slave devices (address 3 and 7).

```
#
# MTCPSI - sample configuration file - Single Unit ID
# - note that all blank lines and comment lines (start with '#') are ignored by
MTCPSI
#
# IP Address definition:
IP 155.177.177.102

#
# Trace log flag definition:
TF,Off

#
# Modbus register limits definition:
RL, – 2147483648, 2147483647

#
# Register mapping definitions:
#
# Unit ID: 1
# - the following register mapping definitions allocate the first two registers of
each register type

# Discrete outputs
RM,1,1,TEST_POINT_DOUT_A
RM,1,2,TEST_POINT_DOUT_B

# Discrete inputs
RM,1,10001,TEST_POINT_DIN_A
RM,1,10002,TEST_POINT_DIN_B

# Analog inputs
RM,1,30001,TEST_POINT_AIN_A
RM,1,30002,TEST_POINT_AIN_A

# Analog outputs
RM,1,40001,TEST_POINT_AOUT_A
RM,1,40002,TEST_POINT_AOUT_B
```

Using Register Mappings Guidelines

This section provides the user with guidelines for defining register mappings.

See the section "Expected Modbus TCP Slave Runtime Behavior" in this chapter, for further details on how the behavior of the Modbus TCP Slave Interface can affect configuration decisions.

Guideline to Organize Records

Guideline to Organize Records

The register mappings (and other types of records) may be specified in any order. To simplify maintenance of the configuration file, order the register mapping records by slave address then register reference. This will aid in detecting unmapped data addresses.

Since the Modbus TCP Slave Interface can emulate multiple Modbus TCP Slave devices, one could organize mapped CIMPLICITY HMI points into logical groupings based on a functional area.

Guideline to Optimize Throughput

Guideline to Optimize Throughput

The Modbus TCP Slave Interface supports several Modbus requests that allow a range of data addresses (or an array of values) to be specified. Note that these requests specify a contiguous set of data addresses.

To maximize throughput, avoid gaps in allocated data addresses. This will reduce the transfer of "meaningless" values.

In addition, map Boolean points to coil (0X) or input status (1X) data addresses. Modbus requests that handle coil or input status data addresses pack sixteen (16) values into one word (two bytes). Modbus requests that handle input register or holding register data addresses require one word per value.

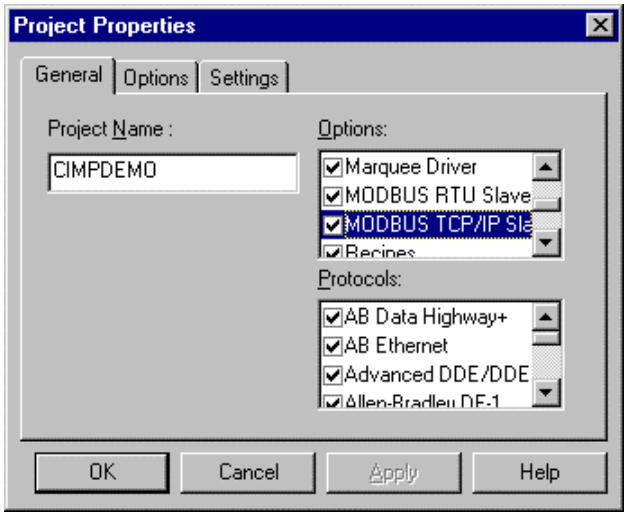
Another way to maximize throughput is to allow the Modbus master to reduce the number of transactions by increasing the range of data addresses in each request. *See the section "Function Codes Supported by Modbus TCP Slave " in this chapter for limits on the number of coils or registers that may be specified or included in a single Modbus message.*

Step 2 of 3. Select the Modbus TCP Slave Protocol

To add the Modbus TCP Slave communications enabler to your project:

1. Load an existing project (or create a new project) in the CIMPLICITY HMI Workbench.
2. Click Project on the Workbench menu bar.
3. Select Properties.

   The Project Properties dialog box opens.
4. Select the General tab.
5. Check MODBUS TCP SLAVE in the Options box.



6. Click **OK** to save the changes.

Step 3 of 3: Implement the Modbus TCP Slave Configuration

To apply Modbus TCP Slave configuration changes, start the associated CIMPLICITY HMI project. If the project is currently running, stop then restart the Modbus TCP Slave resident process.

The start order for implementing the Modbus TCP Slave configuration is:

- Start the associated CIMPLICITY HMI project.
- Start the Modbus TCP Slave resident process.

Starting the Associated CIMPLICITY HMI Project

You need to start the associated CIMPLICITY HMI project in order to start the Modbus TCP Slave Interface.

To start the associated CIMPLICITY HMI project:

1. Open the associated project in the CIMPLICITY HMI Workbench.
2. Either:

   Method 1

   A. Click Project on the Workbench menu bar.

   B. Select Run.

   Method 2

   Click the **Run** button on the Workbench toolbar.
3. Check the list of started resident processes for the name **`MTCPSI_RP`**.

Modbus TCP Slave Troubleshooting

There are several diagnostic tools available to the user. These tools are particularly valuable if runtime behavior deviates from expected behavior. They can help isolate and troubleshoot the erroneous or erratic behavior of a working system.

Diagnostic tools include the following:

- CIMPLICITY HMI Status Log
- Protocol Stack Trace Log
- Modbus Exception Codes
- Test Program

Expected Modbus TCP Slave Runtime Behavior

This section describes the expected behavior of the Modbus TCP Slave Interface. This description provides the user with a reference point for using the diagnostic tools.

Data Address Space

The Modbus TCP Slave Interface maintains a data address space that mimics one or more PLCs and their associated coils and/or registers.

The user configuration will implicitly define the limits of valid data addresses for each unique combination of memory type and slave address. The minimum data address for any given memory type is 0 (zero-based). The maximum data address for a given memory type is the highest data address specified in the configuration. For example, if the highest holding register in slave address 1 is 40150 (one-based), then the maximum data address for memory type 4X is 149 (zero-based).

Guidelines. All data addresses in the address space are set to binary 0 on startup. If a data address is not mapped to a CIMPLICITY HMI point, then the following rules apply:

1. If the data address is a read-write address (memory type 0X or 4X), then a Modbus master may update (or read) the data address value. Thus, the data address may act as a memory store.
2. If the data address is a read-only address (memory type 1X or 3X), then a Modbus master may only read the data address. Thus, the data address value is always binary zero (0).

Modbus master data address references outside the configured range (i.e. greater than the highest user-specified data address for a given memory type and slave address) shall generate an exception response. *See the section "Using Modbus Exception Codes" in this chapter for more information.*

Data Types

The Modbus TCP Slave Interface supports mapping of all non-text (i.e. analog or Boolean) CIMPLICITY HMI points to Modbus data addresses. Non-array points are mapped to a single data address as specified in the register mapping definition. Array points and bitstring points are mapped to multiple consecutive data addresses, with the first element mapped to the register specified in the register mapping definition.

Data Flow

To maintain the current value of each mapped CIMPLICITY HMI point within the data address space, the Modbus TCP Slave Interface will accept unsolicited updates (from CIMPLICITY) for all mapped points. Thus, the Modbus master may read values from CIMPLICITY HMI points mapped to any supported memory type (0X, 1X, 3X, and 4X).

However, the Modbus TCP Slave Interface will only attempt to write to CIMPLICITY HMI points that are mapped to data addresses of memory type 0X or 4X. Thus, the Modbus master may write values to CIMPLICITY HMI points mapped to data addresses of memory type 0X or 4X.

Note that for a Modbus master write request to succeed, all data addresses specified must be valid and all corresponding values must be written successfully to PTMAP.

Data Coercion

The Modbus TCP Slave Interface performs run-time coercion for all data types.

Discrete data types are coerced according to the following guidelines.

Memory Type	Data Source	Source Value	Target Value
0X	CIMPLICITY HMI	zero (0)	0
	CIMPLICITY HMI	non-zero (!= 0)	1
	Modbus master	0	0
	Modbus master	0xFF or 0x01 (depends on function code)	1
1X	CIMPLICITY HMI	zero (0)	0
	CIMPLICITY HMI	non-zero (!= 0)	1

Guidelines. Analog data types are coerced according to the following guidelines.

1. For analog points with engineering units, the Modbus TCP Slave Interface will use the engineering unit value when converting to/from Modbus data values.
2. For analog points without engineering units, the Modbus TCP Slave Interface will transfer the raw value.

See the section "Modbus Register Limits Record" in this chapter to define these limits.

Write Response Time

For a given Modbus master write request, the Modbus TCP Slave Interface will wait for all set point requests to complete before returning a response to the Modbus master. Since the set point requests are non-deterministic, no response time can be guaranteed for a write request. The Modbus master should be prepared to adjust its timeout parameter accordingly.

Dynamic CIMPLICITY HMI Configuration Changes

CIMPLICITY HMI supports reconfiguration of point properties while the project is running. The point properties that directly impact the behavior of the Modbus TCP Slave Interface include the following:

- Access rights
- Data type

- Array size

The Modbus TCP Slave Interface monitors the project database for changes in point properties. Once notified, point property changes are applied immediately.

Example

Changing the access rights for a point from read-write to read-only will cause Modbus write requests (that specify the corresponding data address) to fail.

In particular, changes to the array size of a point may have unexpected results. At startup, the Modbus TCP Slave Interface determines the array size for every mapped point. By definition, a scalar point has an array size of 1. In combination with other tests, the Modbus TCP Slave Interface uses the array size to ensure that every array element is mapped to a unique Modbus data address. The array size determined at startup becomes the maximum size allowed. Thus, while the array size may be reduced, the Modbus TCP Slave Interface ignores increases.

Using the CIMPLICITY HMI Status Log

If an error is detected, the Modbus TCP Slave interface logs:

- Error messages on startup.
- Informational warning and error messages at runtime.

Modbus TCP Slave Interface Startup Error Messages

On startup, the Modbus TCP Slave Interface validates the contents of the configuration file. *See the section "Modbus TCP Slave Configuration Overview" in this chapter for creating and editing the configuration file.* If an error is detected, an error message is logged. These error messages include the following:

Message	Cause / Resolution
Error opening configuration file (see next message).	The configuration file could not be opened. The following message provides more details. Ensure that a valid configuration file exists in the required directory. *See the section "Understanding the File Naming Convention" in this chapter.* Ensure that another application is not currently using the file.
Error reading from configuration file.	The configuration file could not be read. Check the file for invalid control characters. If necessary, replace the file with a backup copy, or rebuild the file using the provided template.
Configuration file contains more than one IP address parameters record.	Ensure that the configuration file contains only one record with the prefix "IP".
Configuration file does not contain any IP address parameters record.	The configuration file must contain a record with the prefix "IP".
Configuration file contains more than one trace log parameters record.	Ensure that the configuration file contains only one record with the prefix "TF".

Configuration file contains more than one Modbus register limits record.	Ensure that the configuration file contains only one record with the prefix "RL".
Configuration file does not contain any register mapping record.	The configuration file must contain at least one register mapping record (prefix "RM").
Configuration file contains the following invalid record (see next message).	Detected a record that is not a comment nor a blank line nor a valid definition. The following message contains the record. Ensure that the record starts with a valid record prefix or a valid comment character.
<record type> record is invalid.	For the given type of record, some or all of the required fields are missing, or are not properly delimited.
<record type> record contains an invalid <field name> field.	For the given type of record, the given field is not defined or contains invalid characters.
<record type> record specifies an invalid <field name>.	For the given type of record, the given field specifies an invalid parameter value (for example, the value is out of range).
Modbus register limits record specifies an invalid pair of limits.	The low register limit equals or exceeds the high register limit.
Duplicate register reference detected (see next two messages).	Detected two register mapping records that specify the same Modbus data address (slave address and register reference). The next two messages give the register mapping parameters (and array size) of the current and duplicate records. If the two records do not specify the same Modbus data address, check the array size of the CIMPLICITY HMI point specified in the Duplicate register mapping and ensure that sufficient data addresses are reserved.
Duplicate point identifier detected (see next two messages).	Detected two register-mapping records that specify the same CIMPLICITY HMI point. The next two messages give the register mapping parameters (and array size) of the current and duplicate records.
Unsupported data type for point: <point id>.	The data type of the given CIMPLICITY HMI point is not supported. *See the section "CIMPLICITY HMI Specifications for Modbus TCP Slave " in this chapter.*

Modbus TCP Slave Interface Runtime Error Messages

The Modbus TCP Slave Interface logs informational, warning, and error messages to the CIMPLICITY HMI project status log. These messages include the following:

Message	Cause / Resolution
Program startup completed successfully	Informational message - no action required.
Program shutdown completed successfully	Informational message - no action required.
Memory allocation error	Error creating an internal data structure. Increase available memory by stopping non-essential applications.
Error opening communication port channel: x.	Error occurred while connecting to the given COM port. Ensure that the given COM port is valid.
Error coercing Modbus value to CIMPLICITY point value (see next message).	The value of the given CIMPLICITY HMI point cannot be converted to the mapped Modbus memory type. Ensure that the value is within the Modbus Register Limits. *See the section "Modbus Register Limits Record" in this chapter.* Ensure that the data type is supported. *See the section "CIMPLICITY HMI Specifications for Modbus TCP Slave" in this chapter.*
On-change response coercion error for point: <point id>.	(see the previous message)

Important: The Modbus TCP Slave Interface also logs messages intended for use by GE Fanuc support personnel. If any of the following messages are logged, please contact your CIMPLICITY HMI vendor for support.

- Error initializing protocol layer object: xxx.
- Error registering slave addresses in protocol layer object: xxx
- Thread creation failed.
- Error occurred while waiting for thread to exit.
- Event object creation failed.
- Error occurred while setting event object.
- Failed to allocate an event flag from PTMAP subsystem.
- Error occurred while waiting for a response from the PIL worker thread.
- An invalid PTMAP response message was received. Response ignored.
- Invalid register count: xxx.
- Duplicate entry detected for slave address xxx, register class xxx.

Using the Protocol Stack Trace Log

The protocol stack trace log provides the user with an indication of the Modbus messages received and sent by the Modbus TCP Slave Interface at the communications port level. Each logged message is time stamped.

The user may enable or disable trace logging by defining a trace log parameters record within the Modbus TCP Slave Interface configuration file. *See the section "Trace Log Parameters Record" in this chapter.*

When enabled, the Modbus TCP Slave Interface writes protocol stack trace messages to the file **`MTCPSI.err`** in the **`log`** sub-directory of the Project root directory.

Example

If the Project had been created in the directory **`C:\CIMPLICITY\HMI\Projects\test\`**, then the trace message file specification is **`C:\CIMPLICITY\HMI\Projects\test\log\mtcpsi_rp.err`**.

The following is an excerpt from an actual trace log file.

```
1999-11-09 16:35:34.876 Started Modbus TCP Slave Interface (MTCPSI_RP) – Using IP
address 0.0.0.0
1999-11-09 16:37:29.010 Accepted connection [id = 524] from IP address
155.177.177.102 – bound to local IP address 155.177.177.102
1999-11-09 16:37:36.250 <- [id = 524] 000100000006 010300000064
1999-11-09 16:37:36.290 -> [id = 524] 0001000000CB
0103C8000100020003000400050006000700080009000A000B000C000D000E000F001000110012001300140015001600170018001900 1A001B0001C001D001E001F00200021002200230024002500260027002800290002A002B002C002D002E002F00300031003200330034003500360037003800390003A003B003C003D003F004000410042004300440045004600470048004900 4A004B004C004D004E004F005000510052005300540055005600570058005900 5A005B005C005D005E005F006000610062006300 64
.
The above will be repeated several times. It represents the Read Holding Registers
transaction
.
1999-11-09 16:40:11.503 <- [id = 524] 0001000000CF
011000630064C8007F007F007F
```

<*slave address*> is the emulated slave device address.

<*function code*> is one byte representing the requested operation. If an exception response is generated, the high bit is set.

<*data*> is one or more bytes containing function parameters, data values, and/or exception code.

<*CRC*> is trailing two bytes containing the cyclical redundancy check value.

Using Modbus Exception Codes

The user may diagnose errors by examining response messages returned by the Modbus TCP Slave Interface to the Modbus master. Certain conditions will cause the Modbus TCP Slave Interface to return exception responses. This section documents the supported Modbus exception codes and their possible causes.

Exception Code	Cause
0x01 (Illegal Function)	Modbus request specifies an unsupported function code. *See the section "Function Codes Supported by Modbus TCP Slave " in this chapter for a list of functions supported by the Modbus TCP Slave Interface.*
0x02 (Illegal Data Address)	Modbus request specifies an invalid data address, or specified a data address range that extends beyond the highest configured data address.
0x03 (Illegal Data Value)	Modbus write request specifies an analog data value that exceeds the data type range or the configured EU limits of the associated CIMPLICITY HMI Point.
0x04 (Slave Device Failure)	Modbus write request specifies a data address mapped to a disabled, unavailable, or read-only CIMPLICITY HMI Point.

The format for a Modbus exception response message is:

<*slave address*><*function code*><*exception*><*CRC*>

Where

<*slave address*> is the emulated slave device address.

<*function code*>is one byte representing the failed operation. Note that the high bit is set.

<*exception*> is one byte representing the exception code. See table above.

<*CRC*> is trailing two bytes containing the cyclical redundancy check value.

Modbus TCP Slave Test Program

CIMPLICITY HMI provides a sample Modbus master test program. The test program generates Modbus requests and displays the received responses.

For more information regarding the test program, refer to the CIMPLICITY HMI Device Communications Manual (GFK1181G), Modbus TCP Communications, Validating Modbus TCP Communications.

OMRON Host Link Communications

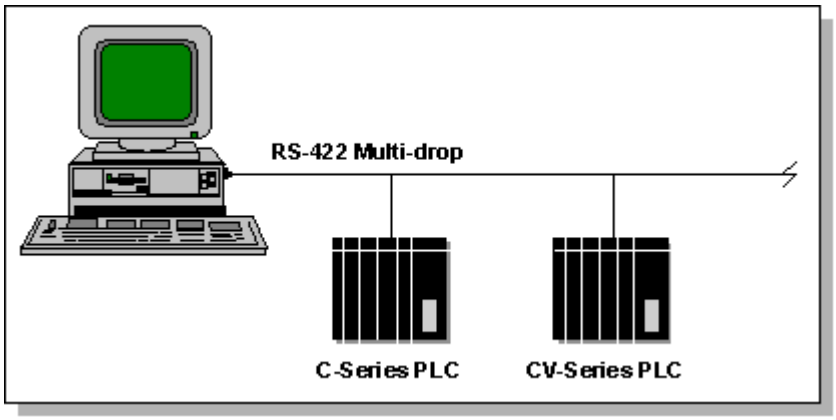
About OMRON Host Link Communications

The OMRON® Host Link communications enabler supports OMRON C-Series and CV-Series programmable controllers in point-to-point and multi-drop configurations with one master device where the CIMPLICITY Host Link Communications enabler acts as the master.

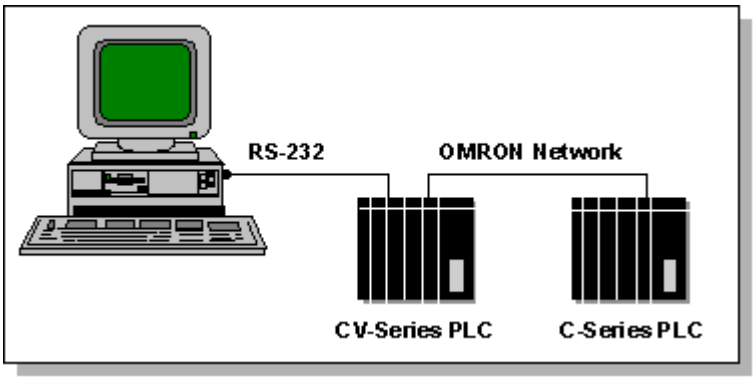
The OMRON Host Link Communications provides read and write access to the OMRON programmable controllers via a Host Link System Network. You can make RS-232 or RS-422 connections through the built in Host Link interface on the programmable controller's CPU or through an optional Host Link Unit in the OMRON PC's rack.

All communication commands are implemented as master/slave communications where the CIMPLICITY OMRON Host Link communications enabler acts as the master responsible for requesting data from or writing data to OMRON programmable controller(s). Unsolicited data sent from OMRON programmable controllers is not supported.

You can connect up to 32 OMRON programmable controllers to a host computer via multi-drop RS-422 line.



You can connect to one OMRON C-Series or CV-Series programmable controller via an RS-232 line.



This enabler supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integer
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Supported Protocols

The protocol that you use to communicate to an OMRON programmable controller is determined by the **Model type** and **Address** you configure for the programmable controller in a CIMPLICITY HMI project. The **Address** defines whether the programmable controller is connected via the local Host Link network through an inter-network connection.

The device communication enabler supports two different protocols and command sets. The two protocols are:

- C-mode

  Use C-Mode commands to communicate directly with OMRON C-Series programmable controllers.

- CV-mode or FINS

  Use FINS commands to communicate directly with OMRON CV-Series programmable controllers. FINS commands also allow inter-network communications to networked OMRON programmable controllers. In this configuration, a CIMPLICITY HMI project communicates to C- or CV-Series programmable controllers via a primary CV-Series programmable controller.

Supported OMRON Devices

The OMRON C-Series and CV-Series device communication enabler supports communications to the following programmable controllers:

Communications via C-mode Host Link:

C20	C120/C500	CxxK	C2000
C200H	C1000H	C2000H	CQM1
C200HS	CPM1	C200HX	C200HG
C200HE			

Communications via CV-mode Host Link:

CV500	CVM1-CPU01-E	CV1000	CV2000
CVM1-CPU11-E	CVM1-CPU21-E		

The following C-Series programmable controllers are supported when connected to a subnetwork, that is through a CV bridge, with FINS commands:

- C200H-CPU11-E (requires use of C200HSLK11/SLK21-V1 SYSMAC LINK Unit)
- C1000H-CPU01-EV1 (requires use of C1000H-SLK11/SLK21-V1 SYSMAC LINK Unit)
- C2000-CPU-EV1 (requires use of C1000H-SLK11/SLK21-V1 SYSMAC LINK Unit).

When configuring communications to programmable controllers on subnetworks, you must ensure that the programmable controllers attached to the Host Link is configured with the proper routing tables to reach the desired programmable controllers on the subnetworks. Refer to the OMRON documentation for details on setting up these routing tables.

Supported Addresses

The OMRON programmable controllers contain multiple data areas that consist of channels of 16-bit data and completion bit data (timers and counters). The type of areas and number of channels depends on the OMRON programmable controller model. Depending on the logic programmed, the 16-bit values may represent individual I/O bits, one 16-bit data, or multiple 16-bit data. The amount of data read and returned to CIMPLICITY HMI software is determined by the Point Type configured for the address selected.

Read/Write Areas for C-Series on Local Host Link

The Read/Write areas and ranges supported for C-Series programmable controllers on the local Host Link are:

Memory Area	Address Entry
Core I/O (CIO)	000 to 255
Link Relays (LR)	LR000to LR63
Holding Relays (HR)	HR00 to HR99
Auxiliary Area (AR)	AR00 to AR27
Timer Present Value (PV)	TPV000 to TPV511
Counter Present Value (PV)	CPV000 to CPV511
DM Area	DM0000 to DM9999
Status	ST*

Read-Only Areas for C-Series on Local Host Link

The Read Only areas and ranges supported for C-Series programmable controllers on the local Host Link are:

Memory Area	Address Entry
Timer Completion Flag	TIM000 to TIM511
Counter Completion Flag	CNT000 to CNT511
Error Read w/ Clear	EC0, EC1*
Error Read w/o Clear	ER0, ER1*

* These areas are not accessible when communicating with the programmable controller via a CV bridge.

Read/Write Areas for CV-Series

The Read/Write areas and ranges supported for CV-Series programmable controllers are:

Memory Area	Address Entry
Core I/O (CIO)	000 to 2555
CPU Bus Link Area (G)	G000 to G255
Auxiliary Area (A)	A000 to A511
Timer Present Value (PV)	TPV0000 to TPV1023
Counter Present Value (PV)	CPV0000 to CPV1023
DM Area (DM)	DM00000 to DM24575
Expansion DM (E)	E00000.b to E32765.b where b is the bank number Available for CV1000, CV2000, CVM1-CPU11-E or other OMRON programmable controllers with Expanded DM

Read-Only Areas for CV-Series

The Read Only areas and ranges supported for CV-Series programmable controllers are:

Memory Area	Address Entry
Timer Completion Flag	TIM000 to TIM1023
Counter Completion Flag	CNT000 to CNT1023
Temporary Relay Area (TR)	TR0 - TR7

OMRON Required Documents

In order to properly configure OMRON programmable controllers and their Host Link port(s) you must refer to the Operations and System manuals for the appropriate programmable controller. If you are using a Host Link Unit, then the User's Manual for that interface is required.

These manuals contain important information on:

- Setting the Host Link port's communication parameters such as address, communication speed and parity.
- Constructing the proper RS-232 and RS-422 cable(s) for connecting the CIMPLICITY computer to the Host Link system.
- Interpreting response codes returned from programmable controllers and reported to the Status Log.

OMRON Hardware Configuration Requirements

You can connect OMRON programmable controllers via RS-232 or RS-422 connections to either the OMRON programmable controllers built in CPU Host Link interface or through an optional Host Link Unit. Up to 32 OMRON programmable controllers can be connected to a host computer via RS-422 communications on a local Host Link network.

Supported Host Link Units

The following Host Link Units are supported via this communication enabler:

C-Series Host Link Units:

C200H-LK201	C200H-LK202	C500-LK201-V1
3G2A5-LK201-EV1	C500-LK203	3G2A6-LK201-EV1
3G2A6-LK202-EV1		

CV-Series Host Link Units:

CV500-LK201

The choice of module should be based on your OMRON programmable controller models and Host Link System requirements. Please consult OMRON documentation on the features and uses of each of the listed interface modules.

If the OMRON programmable controllers are to be connected via RS-422 then you may need an RS-232 to RS-422 converter or RS-422 cards for your computer. Contact OMRON to determine the best converter for your configuration.

Default Communication Parameters

The following communication parameters are used by the OMRON communication enabler and cannot be changed. The Host Link modules in the PLC must be configured to match these settings:

Parameter	Value	Description
Data Bits	7	Number of data bits used in transmissions
Stop Bits	2	Number of stop bits used in transmissions

The following communication parameters must match the Port configuration parameters for the OMRON communication enabler in CIMPLICITY HMI software:

- Baud Rate
- Parity

OMRON PLC Cabling Diagrams

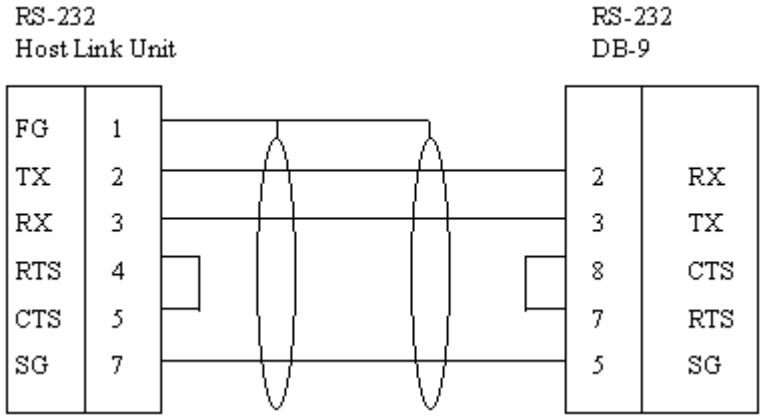
The following diagrams are intended to provide general guidance for the construction of the cable used to connect the CIMPLICITY HMI computer to the Host Link network port. You should always refer to the appropriate Host Link Unit's *System Manual* that comes with your Host Link Adapter for detailed diagrams for your particular adapter model and network configuration.

C-Series Host Link Adapters

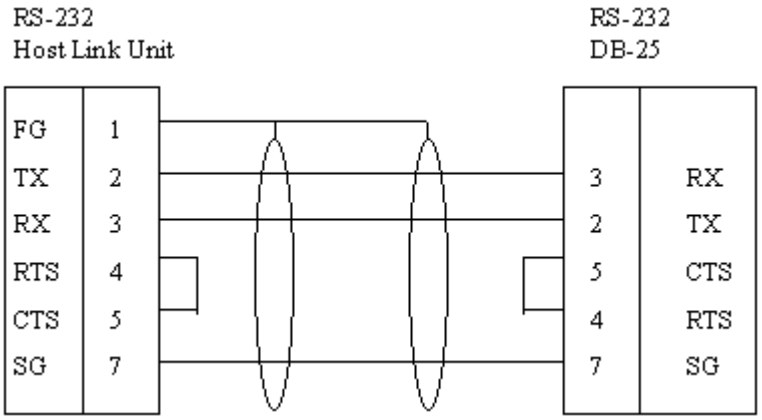
For C-Series Host Link Adapters, see the following cabling diagrams for general guidance in construction cables:

- RS-232 Host Link Unit to DB-9 connector
- RS-232 Host Link Unit to DB-25 connector
- RS-422 Interface for C-Series Host Link Adapters

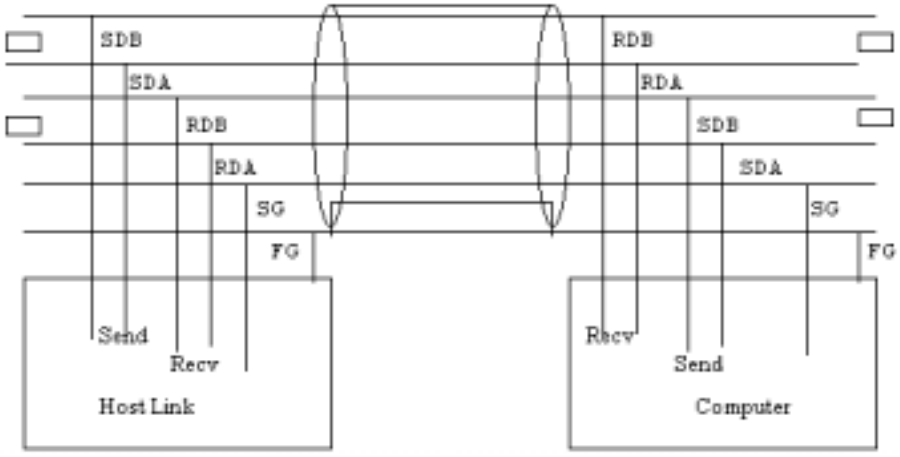
RS-232 Host Link Unit to DB-9 Connector



RS-232 Host Link Unit to DB-25 Connector



RS-422 Interface for C-Series Host Link Adapters

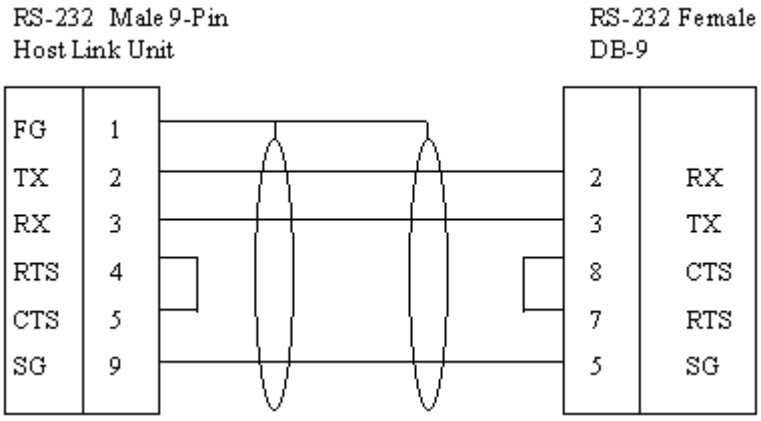


CV-Series Host Link Adapters

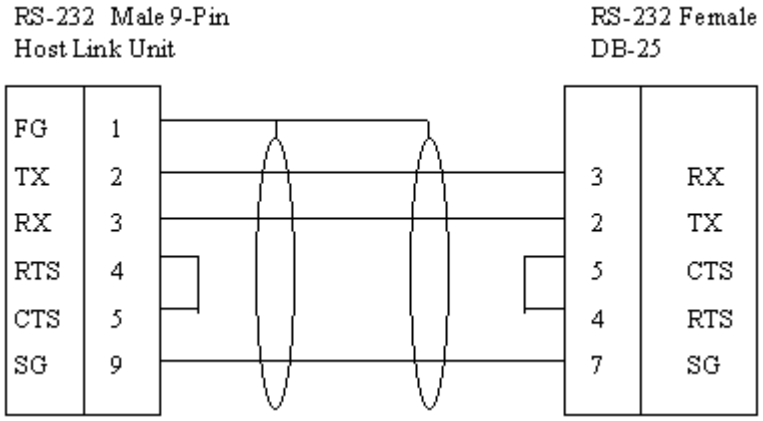
For CV Series Host Link Adapters, see the following cabling diagrams for general guidance in construction cables:

- RS-232 Host Link Unit to DB-9 connector
- RS-232 Host Link Unit to DB-25 connector
- RS-422 Interface for CV Series Host Link Adapters

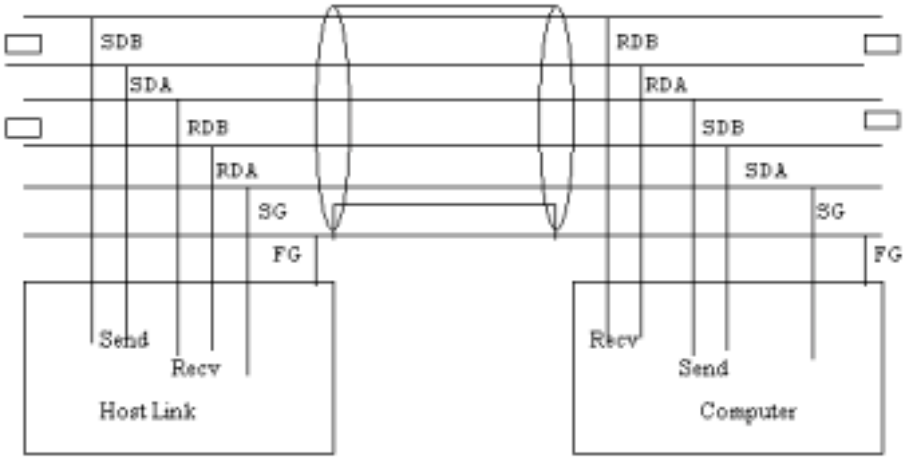
RS-232 Host Link Unit to DB-9 Connector



RS-232 Host Link Unit to DB-25 Connector



RS-422 Interface for CV-Series Host Link Adapters

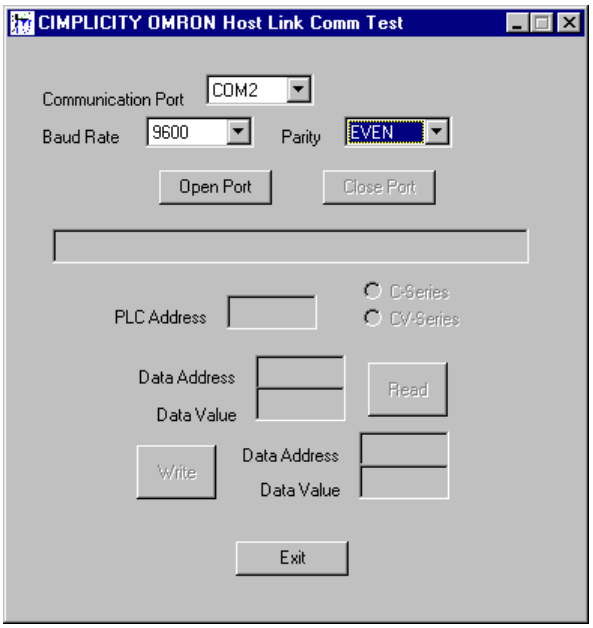


Validating OMRON Communications

You can use the OMRON Host Link Diagnostics program to check the basic configuration, cabling and operation of your network without running a CIMPLICITY HMI project. You can use this program to read and write data from and to a specified OMRON programmable controller. A single value (channel or timer/completion bit) is transferred at a time.

To start the OMRON Host Link Diagnostics program, select the *OMRON Host Link Diagnostics* icon in the CIMPLICITY HMI program group.

The *OMRON Host Link Diagnostics* dialog opens with default parameters selected.



The top section of the dialog contains fields for setting the communication port parameters. A display only field in the center of the dialog displays error and status information. Below the status message field are fields you can use to specify PLC Address, Data Address and Data Values for read and write testing

Opening A Communication Port

To test communication with an OMRON programmable controller you first select its communication port, baud rate and parity. To do this:

1. In the **Communications port** field, select the communication port for the PLC.
2. In the **Baud rate** field, select the baud rate for the programmable controller.
3. In the **Parity** field, select the parity for the programmable controller.
4. Select **Open port** to initialize communications

The status of your request is displayed in the message field.

If an error message is displayed, check that the selected communication port is not in use by another program and that the port is properly configured and available on the PC and operating system.

Selecting A Target Programmable Controller

After you open the communication port, you can select the OMRON programmable controller you want to test. To do this:

1. In the **PLC address** field, enter the address of the OMRON programmable controller. Use the same format you use when configuring the controller for a CIMPLICITY HMI project.

   To enter the address of an OMRON programmable controller on the local Host Link network, enter a single number.

This is the same format you use when defining a device address in CIMPLICITY software

2. To enter the address of an OMRON programmable controller on a subnetwork, use the following format:

   <CV bridge>.<subnetwork number>.<PLC address>

3. Click on the appropriate radio button to select a **C-Series** or **CV-Series** programmable controller.

If you enter an invalid programmable controller address, an error message displays on the status line. You must enter a valid address to continue.

After you enter a valid programmable controller address, the Read and Write Data Address fields are enabled.

Reading Data

You can read data from valid data areas. Valid data areas are determined by the programmable controller type. The format for entering a data address is the same one you use when you configure points for a CIMPLICITY HMI project.

To read data from the targeted programmable controller:

1. Enter the address of the data in the **Data address** field to the left of the **Read** button. This activates the **Read** button
2. Select **Read**.

If the read request completes successfully, the data appears in the **Data value** field and the status message field says the read was successful. All channel data is displayed in hexadecimal. Timer and Count completion status are displayed as 1 or 0.

If the read request fails, an error message is displayed in the status message field.

Writing Data

You can write data to valid data areas. Valid data areas are determined by the programmable controller type. The format for entering a data address is the same one you use when you configure points for a CIMPLICITY HMI project.

To write data to the targeted programmable controller:

1. Enter a valid data address in the **Data address field** to the right of the **Write** button. This activates the **Data value** field.
2. Enter the data value you want to write in hexadecimal notation in the **Data value** field. This activates the **Write** button.
3. Select **Write**.

The status message field displays a message indicating the success or failure of the write request.

The status line will display a message indicating the result of the write operation, either successful or, in the case of a failure, an error message.

Diagnosing Communication Problems

If the read or write request fails, a message is displayed in the status message field giving an indication of the failure. Use this information to help diagnose communication problems. Error messages will include the Error Response Code returned from the target programmable controller where appropriate. Refer to the OMRON Host Link User's Manuals for complete error descriptions. Errors will indicate possible problems with data addresses, programmable controller routing tables, data ranges, etc.

Time-out Errors

Time-out errors may indicate an invalid programmable controller address, incorrect communication parameters settings, or communication port problems. The most common cause of time-out errors is an improperly constructed communication cable.

Closing Communication Port and/or Changing Ports and Configuration

You need to close communications when:

- You are finished with diagnostic testing
- You want to select a different port
- You want to change the port's baud rate or parity.

To close communications, select **Close port**.

Exiting the Diagnostic Program

To exit the OMRON Host Link Diagnostics program:

1. Select **Close port** to close and release the communication port.
2. Select **Exit** to close the dialog and terminate the program.

OMRON Host Link Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to OMRON Host Link communications.

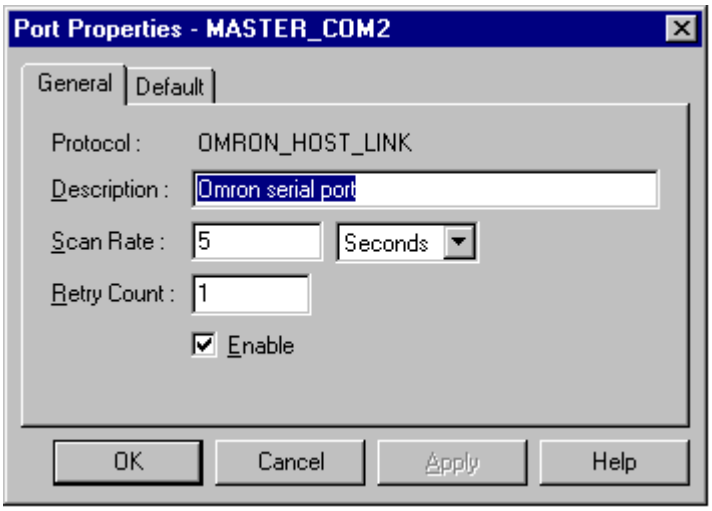
Port Configuration

When you create a new port for OMRON Host Link communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **OMRON_HOST_LINK** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for OMRON Host Link communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

General Port Properties

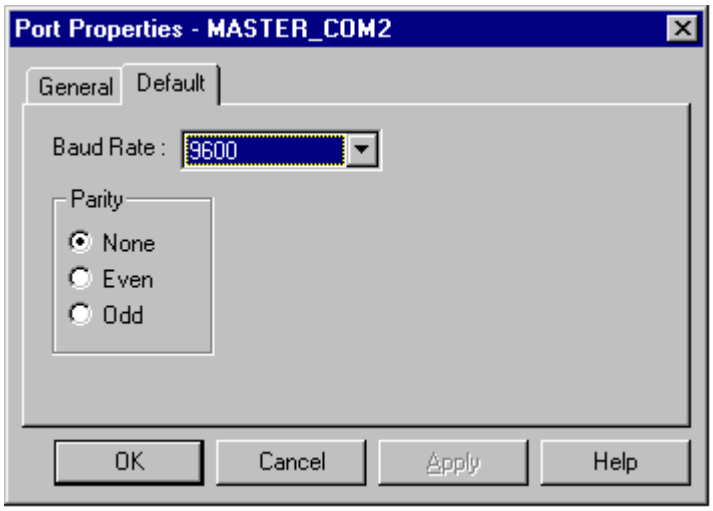


Use the *General* properties to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.
Retry Count	If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it. Enter the number of scans to wait before attempting to reconnect to a device after a communication error has been detected. The recommended **Retry Count** is **3**.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Default Port Properties



Use the *Default* properties to enter communications information for the port. You can define the following:

Baud Rate Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.

Parity Select the parity to be used for the communications

Device Configuration

When you create a new device for OMRON Host Link communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the OMRON Host Link port to be used by the device.

When you select **OK** to create the device, the *Device Properties* dialog box opens.

The information you enter in the *Device Properties* dialog box defines the controller's physical location, or address. The format of the address information depends on the controller type (C-Series or CV-Series) and the controller's location on the attached network. The address information and programmable controller device type you enter are used to establish which protocol will be used within the enabler to talk with the controller.

Domain Size Validation

When you select the **Model type**, you also identify how CIMPLICITY HMI software validates the point addresses against the memory ranges of a target programmable controller.

- When you select **C-Series**, **CV-Series**, **CV-Series Ext** or **CVM1-V2**, dynamic domain sizing is used. In dynamic domain sizing, CIMPLICITY software polls the programmable controller using a binary search algorithm to establish the actual memory ranges.
- When you select **C-Series Static**, **CV-Series Static**, **CV-Series Ext Static** or **CVM1-V2 Static**, static domain sizing is used. In static domain sizing, CIMPLICITY software uses the pre-defined memory ranges based on OMRON's specifications.

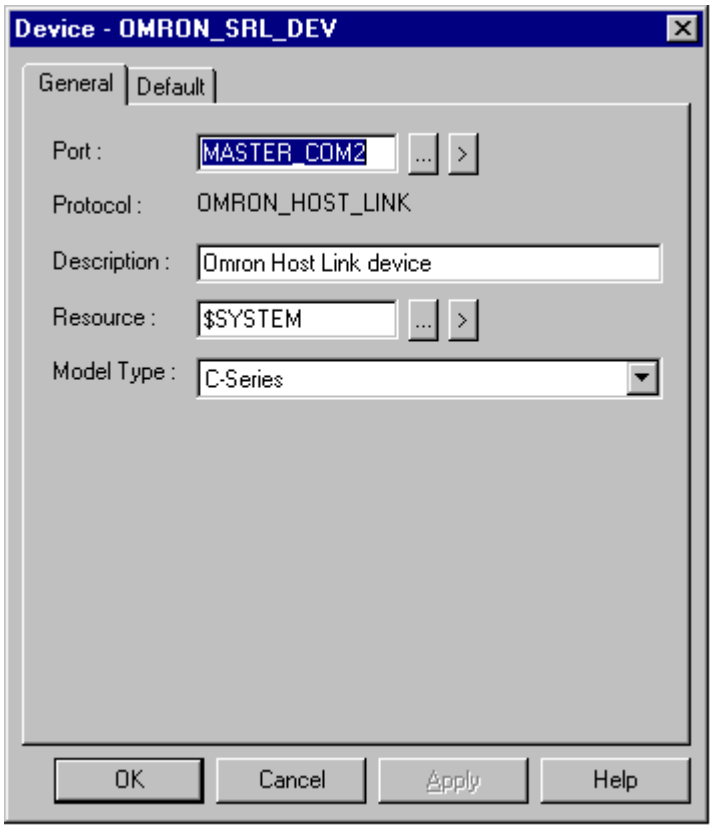
If you use dynamic domain sizing, your CIMPLICITY HMI project startup will take longer as the OMRON device communications enabler polls each OMRON programmable controller to determine its memory sizes. It is recommended that you use model types that employ dynamic domain sizing during project development, then switch to model types that employ static domain sizing when you deploy the project.

Determining the Protocol

The OMRON device communications enabler selects the protocol for a device based on the model type and address you configure for the device.

- If you select the **CV-Series**, **CV-Series Static**, **CV-Series Ext.**, **CV-Series Ext. Static**, **CVM1-V2** or **CVM1-V2 Static** model type, the OMRON communications enabler uses CV-mode (FINS) protocol.
- If you select the **C-Series** or **C-Series Static** model type, the protocol depends on the device's address.
  - If the address indicates the device is on a local Host Link network, the OMRON device communications enabler uses C-mode protocol.
  - If the address indicates the device is on a subnetwork, then the OMRON device communications enabler uses CV-mode protocol.

General Device Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - ... - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - > - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource Enter a resource that can be associated with this device for alarm generation.

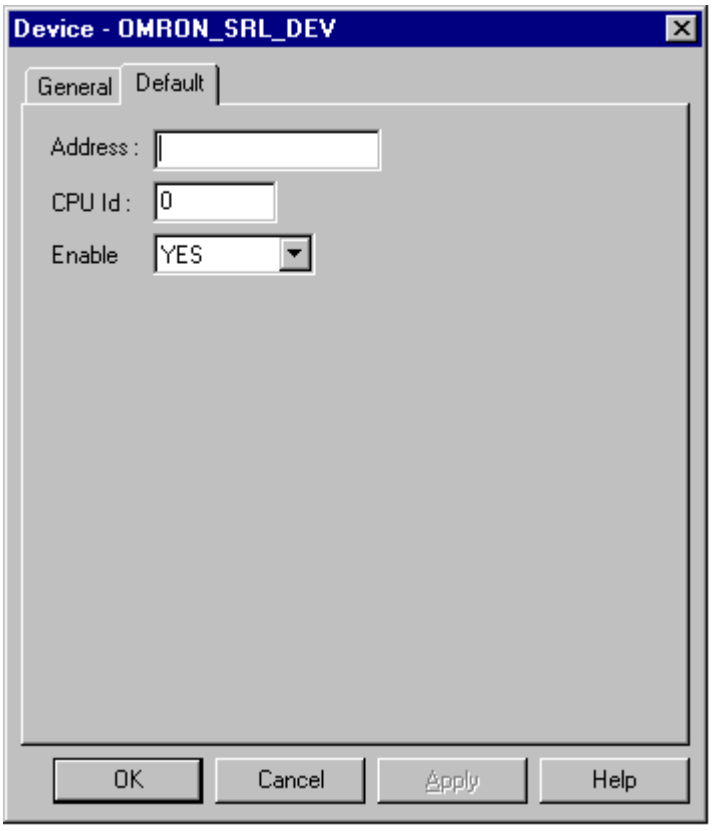
- You can click the Browser button - ... - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - > - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type

Select the type of device. Click the drop-down button to the right of the input field to display your choices. Use the following information to make your selection.

Model Type	Supported Programmable Controllers
C-Series and **C-Series Static**	C20, C120/C500, CxxK, C2000, C200H, C1000H, C2000H, CQM1, C200HS, CPM1, C200HX, C200HG and C200HE
CV-Series and **CV-Series Static**	CV500, CVM1-CPU01-E
CV-Series Ext. and **CV-Series Ext. Static**	CV1000, CV2000 and CVM1-CPU11-E or others with Expanded DM
CVM1-V2 and **CVM1-V2 Static**	CVM1-CPU21-EV2 and programmable controllers with IEEE Floating Point capability

Default Device Properties



Use the *Default* properties to enter addressing information about this device.

Address

Enter one of the following:

- For programmable controllers on a local Host Link, enter the programmable controllers Unit Address.

  Sample local address: 10

- For programmable controllers on a subnetwork, use the following format:

<CV bridge>.<subnetwork number>.<address>

where **<CV bridge>** is the CV bridge on the local Host Link network, **<subnetwork number>** is the subnetwork number, and **<address>** is the Unit Address of the programmable controller.

Sample subnetwork address: 3.4.10

Note

Some C-Series PLC models cannot be accessed on a subnetwork via a CV Bridge. Please refer to the Supported OMRON Devices section for information on which C-Series models are supported via a CV Bridge.

CPU ID

Not used.

Enable

Select **YES** to enable the device when the project starts. If you select **NO**, the device will not be enabled and points associated with the device will be unavailable.

Point Configuration

Once your devices are configured, you may configure points for them. Through device point configuration, you may configure the following:

- Points that read or set discretes and/or bits in memory
- Points to read or set CIO, LR, HR, AR and DM memory areas
- Points to read Timer/Counter completion statuses
- Points to read or set Timer and Counter Present Values (PVs)
- Points to read Status and Errors
- Points to set operation mode

The fields described below have configuration values that are unique to, or have special meaning for OMRON Host Link Serial communications.

General Point Properties

On the *General* page, the type of access depends on the point address:

- Select **Read** for points configured for Error reading and Timer/Counter compilation statuses.
- Select **Read/Write** for all other points configured if you wish to be able to set (change) the value.

Device Point Properties

On the *Device* page:

Update Criteria

The update criteria determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by the OMRON Host Link Serial driver at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by the OMRON Host Link Serial driver at regular intervals while users are viewing them.

Address

Enter the point address of the data.

See the *C-Series Point Addresses*, *CV-Series Point Addresses*, and *Notes on Addressing* sections below for more information.

When you configure Boolean points from non-discrete memory (such as CIO, HR or DM) you must also enter data in the following field:

Bit Offset Enter the bit offset in the 16-bit memory word that defines the point where 0 is the least significant bit and 15 is the most significant bit.

Warning

Do not enter a data Bit Offset for Point Type BOOL for Timer and Counter Completion Statuses or Temporary Relay (TR). Leave the field as the default 0.

Point Address Formats

C-Series Point Addresses

For C-Series programmable controllers connected to the local Host Link Network, the following formats are valid:

Memory Area	Address Entry
Core I/O (CIO)	000 to 2555
Link Relay (LR)	LR000 to LR63
Holding Relay (HR)	HR00 to HR99
Auxiliary Relay (AR)	AR00 to AR27
Timer Completion Flag	TIM000 to TIM511
Timer PV	TPV000 to TPV511
Counter Completion Flag	CNT000 to CNT511
Counter PV	CPV000 to CPV511
DM Area	DM0000 to DM9999
Status	ST
Error Read w/ Clear	EC0, EC1
Error Read w/o Clear	ER0, ER1

CV-Series Point Addresses

For CV-Series programmable controllers connected to the local Host Link Network, the following formats are valid:

Memory Area	Address Entry
Core I/O (CIO)	000 to 255
Temporary Relay (TR)	TR0 - TR7
CPU Bus Link Area (G)	G000 to G255
Auxiliary Area (A)	A000 to A511
Timer Completion Flag	TIM000 to TIM1023
Timer Present Value (PV)	TPV0000 to TPV1023
Counter Completion Flag	CNT000 to CNT1023
Counter Present Value (PV)	CPV0000 to CPV1023
DM Area (DM)	DM00000 to DM24575
Expansion DM (E)	E00000.b to E32765.b where b is the bank number Available for CV1000, CV2000, CVM1-CPU11-E or other OMRON programmable controllers with Expanded DM

Notes on Addressing

Please note the following about point addresses for the OMRON device communications enabler:

- Letters in address entries can be upper or lower case
- Leading zeros on address numbers are optional. Example: HR003 is treated the same as HR3.
- Address ranges may be limited by the address space available in the controller device.
- The Error Read w/ Clear and Error Read w/o Clear memory areas are read only - Do not configure points with these addresses as setpoints. Refer to the C-Series Host Link Units manual for details on these memory areas.
- You can use a Status (ST) point as a setpoint to set the operating mode of the controller. When reading Status, the status data from the Status Read response is returned. This data is different from the data written. Refer to the C-Series Host Link Units manual for details on Status Read and Status Write.
- Use BOOL Point Types for Completion flag (TIM and CNT) and Temporary Relay (TR) points.
- Status (ST), Error Read w/ Clear and w/o Clear are not accessible when you communicate with the programmable controller via a CV bridge.

Advanced Configuration Topics

Adjusting the Communications Time-out Parameter

The communications time-out parameter used by the OMRON communications enabler is set to a default value of 7.5 seconds. You can change this parameter in CIMPLICITY software. To do this, add the following record to the Global Parameters file:

```
COM<port>_TO|1|<value>
```

where <**port**> is the communication port number and **<value>** is the time out in *tenths* of seconds. For example,

```
COM1_TO|1|105
```

sets the time out for communications on port COM1 to 10.5 seconds.

For more information on configuring global parameters, see Global Parameters in the *CIMPLICITY HMI Base System User Manual* (GFK-1180).

Default Protocol Parameters

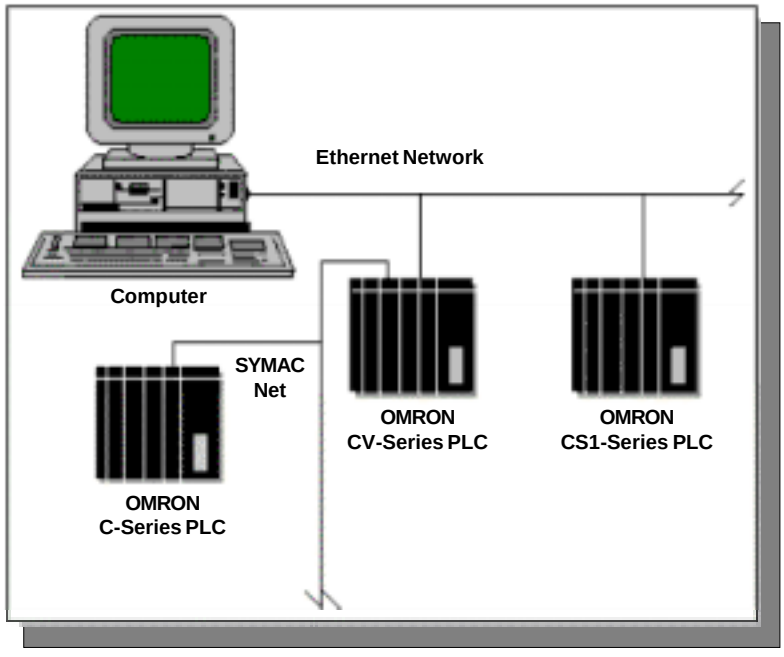
Certain protocol parameters used by the OMRON communications enabler have been preset. They are:

Parameter	Value	Description
DN2	0	Unit Address - 0 indicates the programmable controller's CPU. This is not the same as the unit number (that is, node number) which is configurable.
SNA, SA1	0,0	Source of local network and node number.
SA2	FE	Source of communication unit
SID	FF	Service ID.

OMRON TCP/IP Communications

About OMRON TCP/IP Communications

The OMRON® TCP/IP Communications enabler supports C, CS1 and CV-Series programmable controllers in multi-drop configurations with the OMRON TCP/IP Communication Enabler acting as the master. The OMRON TCP/IP Communications provides read and write access to the OMRON programmable controllers via TCP/IP over an Ethernet network. The CV-Series controller(s) must be equipped with OMRON Ethernet Module(s).



The OMRON TCP/IP Communication enabler supports the CV-mode protocol and command set, also referred to as FINS. The FINS commands are sent in Ethernet UDP datagram transactions. The enabler uses FINS commands to communicate directly with OMRON CV-Series programmable controllers.

FINS commands also allow inter-network communications to networked OMRON programmable controllers. In this configuration, a CIMPLICITY HMI

project communicates to C- or CV-Series programmable controllers via a primary CV-Series programmable controller that acts as a gateway to other networks such as SYSMAC Net and SYSMAC LINK Net.

All communication commands are implemented as master/slave communications where the OMRON TCP/IP Communications enabler acts as the master responsible for requesting data from or writing data to OMRON programmable controller(s). Unsolicited data sent from OMRON programmable controllers is not supported.

This enabler supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Supported OMRON Devices

The OMRON TCP/IP Communication enabler supports direct communications to the following programmable controllers:

CV500	CVM1-CPU01-E	CV1000
CVM1-CPU11-E	CVM1-CPU21-E	CV2000
CS1H-CPU64-V1		

The following C-Series programmable controllers are supported when connected to a subnetwork, that is through a CV bridge, with FINS commands:

- C200H-CPU11-E (requires use of C200HSLK11/SLK21-V1 SYSMAC LINK Unit)
- C1000H-CPU01-EV1 (requires use of C1000H-SLK11/SLK21-V1 SYSMAC LINK Unit)
- C2000-CPU-EV1 (requires use of C1000H-SLK11/SLK21-V1 SYSMAC LINK Unit).

When configuring communications to programmable controllers on subnetworks, you must ensure that the programmable controllers attached to the Ethernet are configured with the proper routing tables to reach the desired programmable controllers on the subnetworks. Refer to the OMRON documentation for details on setting up these routing tables.

Supported Addresses

The OMRON programmable controllers contain multiple data areas that consist of channels of 16-bit data and completion bit data (timers and counters). The type of areas and number of channels depends on the OMRON programmable controller model. Depending on the logic programmed, the 16-bit values may represent individual I/O bits, one 16-bit data, or multiple 16-bit data. The amount of data read and returned to CIMPLICITY HMI software is determined by the Point Type configured for the address selected.

Read/Write Areas for C-Series on Sub-network

The Read/Write areas and ranges supported for C-Series programmable controllers on a sub network are:

Memory Area	Address Entry
Core I/O (CIO)	000 to 255
Link Relays (LR)	LR000to LR63
Holding Relays (HR)	HR00 to HR99
Auxiliary Area (AR)	AR00 to AR27
Timer Present Value (PV)	TPV000 to TPV511
Counter Present Value (PV)	CPV000 to CPV511
DM Area	DM0000 to DM9999
Status	ST*

* These areas are not accessible when communicating with the programmable controller via a CV bridge.

Read-only Areas for C-Series on Local Ethernet

The Read Only areas and ranges supported for C-Series programmable controllers on a sub network are:

Memory Area	Address Entry
Timer Completion Flag	TIM000 to TIM511
Counter Completion Flag	CNT000 to CNT511
Error Read w/ Clear	EC0, EC1*
Error Read w/o Clear	ER0, ER1*

* These areas are not accessible when communicating with the programmable controller via a CV bridge.

Read/Write Areas for CS1-Series

The Read/Write areas and ranges supported for CS1 series programmable Controllers are:

Memory Area	Address Entry
Core I/O (CIO)	0000 to 6143
Aux Relay (A)	A000 to A959
Holding Relay (HR)	HR000 to HR511
Work Relay (WR)	WR000 to WR511
Timer Present Value (TPV)	TPV0000 to TPV4095
Counter Present Value (CPV)	CPV0000 to CPV4095
Data Memory Area (DM)	DM00000 to DM32767
Expansion Data Memory Area (E)	E00000.b to E32767.b where b is the bank number

Read-only Areas for CS1-Series

The Read Only areas and ranges supported for CS1 series programmable Controllers are:

Memory Area	Address Entry
Timer Completion flag (TIM)	TIM000 to TIM4095
Counter Completion flag (CNT)	CNT000 to CNT4095
Task Flag (TK)	TK00 to TK31
Index Register (IR)	IR00 to IR15
Data Register (DR)	DR00 to DR15

Read/Write Areas for CV-Series

The Read/Write areas and ranges supported for CV-Series programmable controllers are:

Memory Area	Address Entry
Core I/O (CIO)	000 to 2555
CPU Bus Link Area (G)	G000 to G255
Auxiliary Area (A)	A000 to A511
Timer Present Value (PV)	TPV0000 to TPV1023
Counter Present Value (PV)	CPV0000 to CPV1023
DM Area (DM)	DM00000 to DM24575
Expansion DM (E)	E00000.b to E32765.b where b is the bank number (CV-Series Ext. only, CV1000, CV2000, CVM1-CPU11-E,…)

Read-only Areas for CV-Series

The Read Only areas and ranges supported for CV-Series programmable controllers are:

Memory Area	Address Entry
Timer Completion Flag	TIM000 to TIM1023
Counter Completion Flag	CNT000 to CNT1023
Temporary Relay Area (TR)	TR0 - TR7

OMRON TCP/IP Required Documents

In order to properly configure OMRON programmable controllers and their Ethernet module(s) you must refer to the ***Operations Manual*** and ***System Manual*** for the appropriate programmable controller and to the OMRON Ethernet module's ***User's Manual***.

These manuals contain important information on:

- Setting up the Ethernet communication parameters such as IP netmask, IP address, FINS UDP Port Number and the IP Address Table to convert between FINS node numbers and IP addresses
- Interpreting response codes returned from programmable controllers and reported to the Status Log.

Important

It is absolutely imperative that you fully understand how to configure the OMRON Ethernet Unit and how it translates between the FINS protocol values SNA, SA1, DNA and DA1 and the IP addresses assigned to the controller(s) and the CIMPLICITY HMI computer. Furthermore, in order to access controllers on sub networks, you must understand how to properly configure routing tables in the programmable controllers.

OMRON TCP/IP Application Notes

For a complete discussion of IP address determination and configuring Port Numbers refer to the OMRON Ethernet module's ***User's Manual***. **You must have a thorough and complete understanding of this information in order to get the enabler to communicate**.

About Datagrams

The OMRON TCP/IP device communication enabler communicates using FINS commands over Ethernet. The FINS commands are exchanged between the computer running a CIMPLICITY HMI project and the controllers in UDP packets. UDP packets are called datagrams. Datagram communication is termed ***connectionless communications*** in contrast to TCP, which is ***connection oriented communications***. With datagram communications, the controllers can communicate with more devices since they do not need to maintain a separate and distinct connection for each device.

UDP datagram service does not guarantee packet delivery, as does TCP. The communication enabler always expects a response for each issued read or write command. If a response is not received within a time-out period you configure, it will retry the command for the number of retries you configure before concluding that the device is "down" or unreachable at the designated address.

UDP datagrams are sent and received over abstractions called ***sockets***, which can be likened to serial communication ports. Multiple sockets can be opened for a given Ethernet interface; hence, the OMRON TCP/IP communication enabler can "share" the Ethernet port with other applications running on the same computer.

About IP Addresses

To send commands to targeted controllers via the UDP datagrams sent through the Ethernet socket, Internet Protocol (IP) addresses are used. You define programmable controller IP addresses to this device communication enabler by entering ***host names***. Host names are resolved to actual IP addresses by looking them up in the operating system's **`hosts`** file. You must ensure that this file contains records for resolving each controller's assigned IP address to a host name. Contact your system administrator or the network manuals for the operating system for instructions on modifying this file. Test the entries by using the **`ping`** utility. **`Ping`** the controller by the host name in order to insure that each entry is correct and that each controller is reachable.

About the Source Computer ID

The controllers must send command responses back to your computer. They send these datagrams to your computer's IP address. The controllers need to determine your computer's IP address in order to do this. You can configure the OMRON Ethernet modules to use two different methods: table look-up and automatic address generation. Both use the SA1 value of your computer. SA1 is the FINS value you assign for the Node Number of your computer on the OMRON Ethernet network.

For the table look-up method, the Ethernet Unit simply looks up the SA1 value sent in the original command in a table your define in the controller to find the computer's IP address. Using OMRON programming software, you must enter both the SA1 and IP address values in the table for each OMRON Ethernet module that uses this method.

For the automatic address generation method, the Ethernet modules use the SA1 value to calculate the IP address by performing a logical AND between the Ethernet Module's IP address and the subnet mask, and then adding the FINS node number (SA1).

About Port Numbers

One final piece of information is required in order for the response to find its way back to the device enabler. The IP address gets the response UDP packet to your computer but now it must find its way to the device enabler *application*. This is done via a Port Number. The device communication enabler connects its socket to a Port Number. This connection processed is called *binding*. The operating system will permit only one application per computer to bind to a given port number.

You configure the controllers to send their responses to this port number. The default FINS UPD Port Number for the OMRON Ethernet Modules is 9600. You instruct the device communication enabler to bind to this number by configuring a Service Name.

The Service Name is resolved to a number in a manner similar to the host name's resolution to an IP address. It is looked up in an operation system file called the **`services`** file when the device communication enabler is first started.

You must add an entry to the **`services`** file relating a service name to a UDP port number which is the same as the UDP Port Number programmed in your OMRON Ethernet Modules. Contact your system administrator or the network manuals for the operating system for instructions on modifying this file.

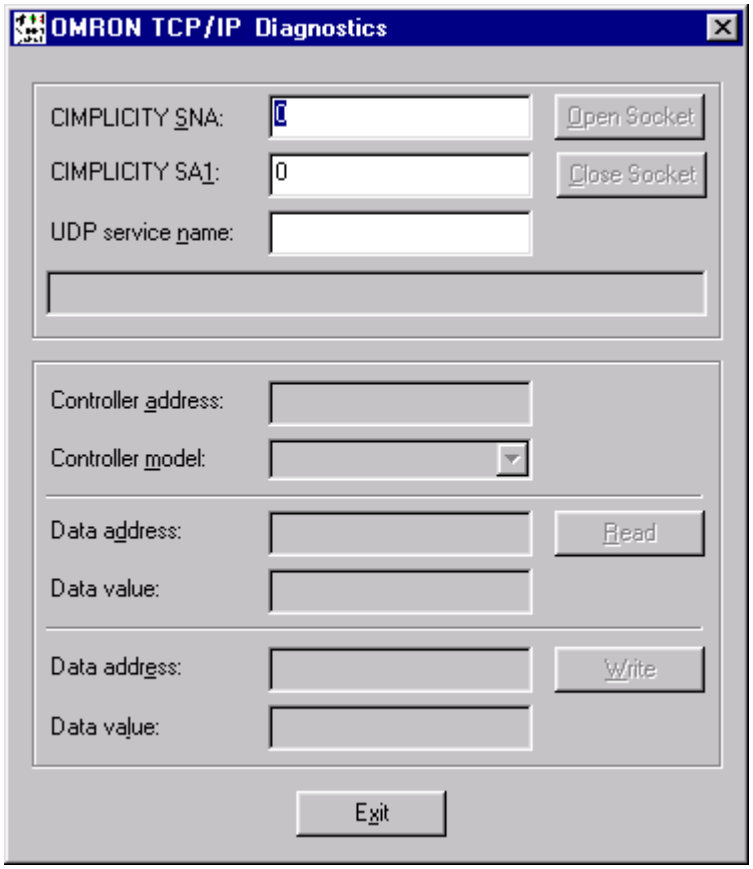
You tell the device communication enabler which name to look up (to find the UDP port number) through the CIMPLICITY HMI project's global parameters. See *Setting Required Protocol Parameters* for further instructions on how to do this.

Validating OMRON TCP/IP Communications

You can use the OMRON TCP/IP Diagnostics program to check the basic configuration, cabling and operation of your network without running a CIMPLICITY HMI project. You can use this program to read and write data from and to a specified OMRON programmable controller. A single value (channel or timer/completion bit) is transferred at a time.

To start the OMRON TCP/IP Diagnostics program, click on the OMRON TCP/IP Diagnostics icon in the CIMPLICITY project's *Configuration Cabinet*.

The *OMRON TCP/IP Diagnostics* dialog box opens with default parameters selected.



The top section of the dialog contains fields for setting the source node information (information on your computer's location on the network) and for selecting a UPD service (port number) for communications. A display only field in the center of the dialog displays error and status information. Below the status message field are fields you can use to specify PLC Address, Data Address and Data Values for read and write testing.

Opening A Communication Socket

To test communication with an OMRON programmable controller, you first specify both a Source Network Address (SNA) and a Source Node number (SA1) for your computer and enter the Service Name corresponding to the UDP Port Number that communications are to use. To do this:

1. In the **CIMPLICITY SNA** field, enter the Source Network Address (SNA) value for your computer that corresponds with the OMRON network configuration.
2. In the **CIMPLICITY SA1** field, enter the Source Node number (SA1) value for your computer.
3. In the **UDP service name** field, enter the UDP service name listed in the TCP/IP services file that corresponds to the Port Number configured in the OMRON Ethernet module(s) that you will be corresponding with.
4. Select **Open Socket** to initialize communications.

The status of your request displays in the message field.

If an error message displays, it gives an indication of the problem that must be corrected before continuing. These problems occur during the opening and binding of the communication socket. Typical problems are:

- TCP/IP support is not loaded and/or configured for the operating system.
- The UDP Service Name entered is not in the TCP/IP service file or is listed incorrectly (as TCP verses UDP for instance).

Selecting A Target Programmable Controller

After you open the communication socket, you can select the OMRON programmable controller you want to test. To do this:

1. In the **Controller address** field, enter the address of the OMRON programmable controller. Use the same format you use when configuring the controller for the CIMPLICITY HMI project.
2. Do one of the following:
   - To enter the address of an OMRON programmable controller on the local Ethernet network, simply enter the Host Name of the controller that corresponds to its IP address.
   - To enter the address of an OMRON programmable controller on a subnetwork, use the following format:

<Host Name>.<subnetwork number>.<Controller address>

   Note: This is the same format you use when defining a device address in CIMPLICITY software
3. Select the controller model from the Controller Model drop down selection list.

If you enter an invalid format for the programmable controller address or if you enter a Host Name that is not valid (not in the TCP/IP hosts file) an error message displays on the status line. You must enter a valid address to continue.

After you enter a valid programmable controller address, the **Data address** and **Data value** fields for read and write requests are enabled.

Reading Data

You can read data from valid data areas. Valid data areas are determined by the programmable controller type. The format for entering a data address is the same one you use when you configure points for a CIMPLICITY HMI project.

To read data from the targeted programmable controller:

1. Enter the address of the data in the **Data address** field to the left of the **Read** button. This activates the **Read** button
2. Select **Read**.

If the read request completes successfully, the data appears in the **Data value** field and the status message field says the read was successful. All channel data is displayed in hexadecimal. Timer and Count completion status are displayed as 1 or 0.

If the read request fails, an error message displays in the status message field.

Writing Data

You can write data to valid data areas. Valid data areas are determined by the programmable controller type. The format for entering a data address is the same one you use when you configure points for a CIMPLICITY HMI project.

To write data to the targeted programmable controller:

1. Enter a valid data address in the **Data address** field to the left of the **Write** button. This activates the **Data value** field.
2. Enter the data value you want to write in hexadecimal notation in the **Data value** field. This activates the **Write** button.
3. Select **Write**.

The status message field displays a message indicating the success or failure of the write request.

Diagnosing Communication Problems

If the read or write request fails, a message is displayed in the status message field giving an indication of the failure. Use this information to help diagnose communication problems. Error messages will include the Error Response Code returned from the target programmable controller where appropriate. Refer to the OMRON Ethernet *User's Manuals* for complete error descriptions. Errors will indicate possible problems with data addresses, programmable controller routing tables, data ranges, etc.

Time-out Errors

Time-out errors may indicate an invalid programmable controller address, an invalid computer SNA and/or SA1 value(s), or an invalid service name.

If the controller is not at the IP address specified by the host name, the target controller will not receive the message and hence will not reply. Test the host name by using the TCP/IP utility **`ping`** (for example, **`ping`** ***`host name`***). If the controller is responding, that means the network is functioning and the device at the IP address related to the host name is responding. If **`ping`** fails, then verify your network is functional and that the targeted programmable controller's Ethernet Unit has been configured for the IP address assigned to host name.

If **`ping`** is successful then the programmable controller's response may not be making it back to the diagnostic test program because of an invalid SNA/SA1 pair or an incorrect port number specified by the entered service name.

SNA should match the network number assigned to the Ethernet network in the OMRON Ethernet Module(s) setup. Either the SA1 value is the value of the IP address of your computer minus the IP netmask *or* it matches a record in the IP Address Table. The choice depends on whether you have configured the OMRON Ethernet module with the IP address conversion method set to automatic generation.

Finally, verify the FINS UDP Port Number you have configured in the OMRON Ethernet Unit matches the value entered in the **`services`** file and that the number is associated with the service name entered.

Closing Communication Socket and/or Changing the Service Name/SNA/SA1 Setup

You need to close the communication socket when:

- You are finished with diagnostic testing
- You want to select a different Service Name, SNA or SA1 value

To close communications, select **Close Socket**.

Exiting the Diagnostic Program

To exit the *OMRON TCP/IP Diagnostics* program:

1. Select **Close Socket** to close and release the communication socket.
2. Select **Exit** to close the dialog and terminate the program.

OMRON TCP/IP Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to OMRON TCP/IP communications.

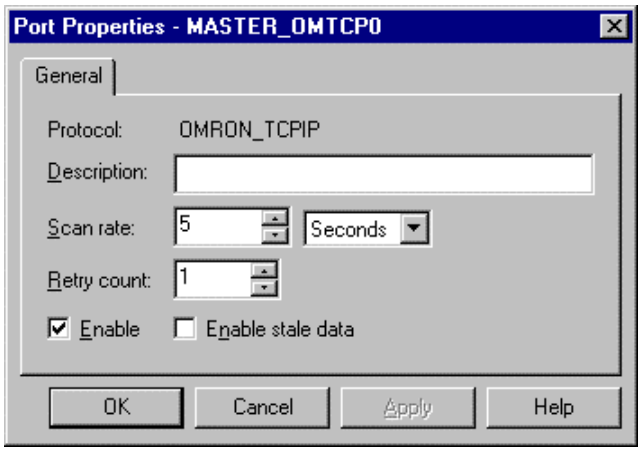
OMRON TCP/IP Port Configuration

When you create a new port for OMRON TCP/IP communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **OMRON_TCPIP** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for OMRON TCP/IP communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

OMRON TCP/IP General Port Properties



Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description — Enter an optional description to help you identify the port.

Scan Rate — Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, or **Hours**.

Retry Count — If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to reconnect to a device after a communication error has been detected. The recommended **Retry Count** is **3**.

Enable	Check if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.
Enable Stale Data	Check to keep the point available in most circumstances that would have made it unavailable. However the point value will be ***stale***, meaning it is the last known value and may or may not have changed in the device.

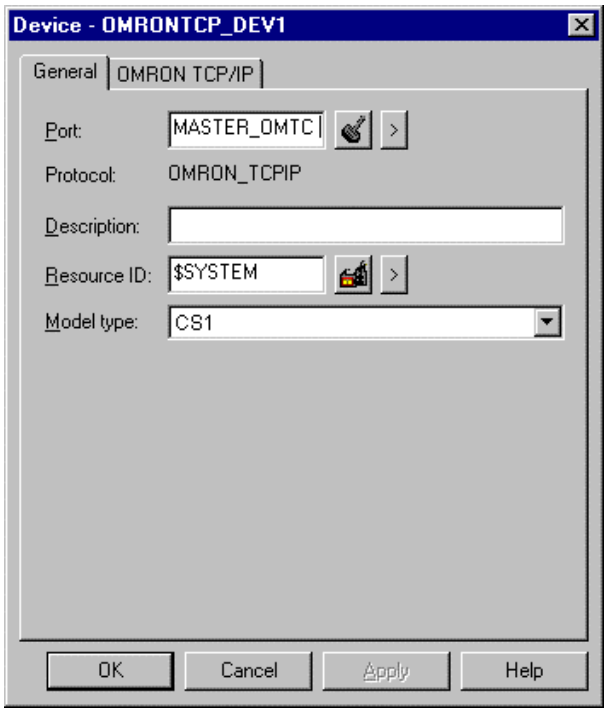
OMRON TCP/IP Device Configuration

When you create a new device for OMRON TCP/IP communications, enter the following information in the New Device dialog box:

1. In the **Devices** field, enter the name of the device you are configuring.
2. In the **Port** field, select the OMRON TCP/IP port to be used by the device.

When you select **OK** to create the device, the Device Properties dialog box opens.

OMRON TCP/IP General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browse button to the right of the field to display the list of ports and select one.
- You can click the Popup Menu button to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browse button to the right of the field to display the list of ports and select one.
- You can click the Popup Menu button to create a new port, edit the current port, or select a port from the list of ports.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices. Use the following information to make your selection.

Model Type	Supported Programmable Controllers
C-Series and **C-Series Static**	C200H-CPU11-E, C1000H-CPU01-EV1 and C2000H-CPU-EV1. Note: C-Series controllers are only accessible via a CV-Series controller acting as a gateway.
CS-1 Series	CS1H-CPU64-V1
CV-Series and **CV-Series Static**	CV500, CVM1-CPU01-E
CV-Series Ext. and **CV-Series Ext. Static**	CV1000, CV2000 and CVM1-CPU11-E or others with Expanded DM
CVM1-V2 and **CVM1-V2 Static**	CVM1--CPU21-EV2 and programmable controllers with IEEE Floating Point capability

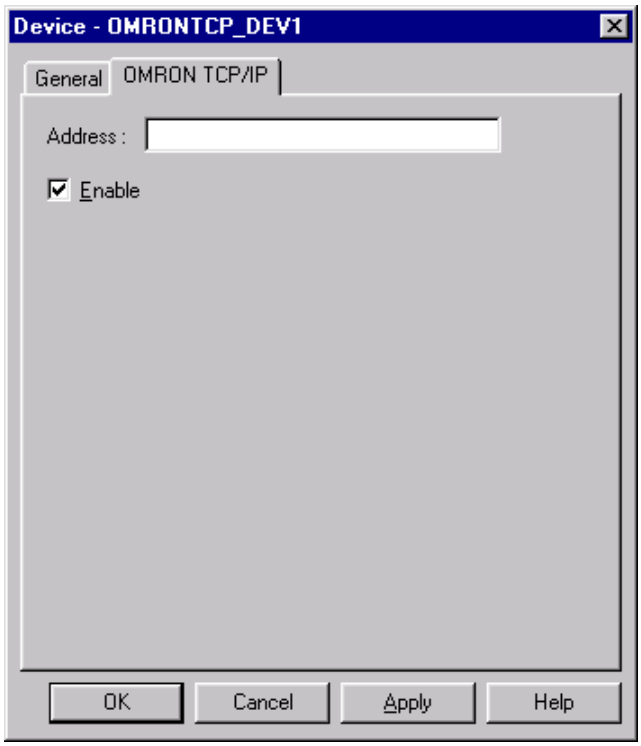
Domain Size Validation

When you select the **Model type**, you also identify how CIMPLICITY software will validate the point addresses against the memory ranges of a target programmable controller.

- When you select **C-Series**, **CV-Series**, **CV-Series Ext** or **CVM1-V2**, dynamic domain sizing is used. In dynamic domain sizing, CIMPLICITY software polls the programmable controller using a binary search algorithm to establish the actual memory ranges.
- When you select **C-Series Static**, **CV-Series Static**, **CV-Series Ext Static** or **CVM1-V2 Static**, static domain sizing is used. In static domain sizing, CIMPLICITY software uses the pre-defined memory ranges based on OMRON's specifications.

If you use dynamic domain sizing, your CIMPLICITY project startup will take longer as the OMRON device communications enabler polls each OMRON programmable controller configured to determine their memory sizes. It is recommended that you use model types that employ dynamic domain sizing during project development, then switch to model types that employ static domain sizing when you deploy the project.

OMRON TCP/IP Device Properties



Use the OMRON TCP/IP tab in the Device dialog box to enter addressing information about this device.

Address

Enter one of the following:

- For programmable controllers connected directly to the local Ethernet network, enter the host name assigned for the IP address at which the controller's Ethernet Unit has been configured.

  Sample local address: **`etchlineB_cntrl`**

- For programmable controllers on a subnetwork, use the following format:

`<host name>.<subnetwork number>.<address>`

where:

`<host name>` is the host name assigned for the IP address of the CV controller acting as bridge on the local Ethernet network.

`<subnetwork number>` is the subnetwork number

`<address>` is the Unit Address of the programmable controller.

An example of a subnetwork address is:

`etchlineB_cntrl.4.10`

Notes on addressing:

The **<host name>** is looked up in the operating system's **hosts** file when the device communication enabler is started to determine the targeted controller's IP address.

If the **<host name>** includes dots, you can enclose the host name in quotations. For example,
"omron_cntrl.net2".2.31

The **<subnetwork number>** is the DNA and **<address>** is DA1 in OMRON FINS protocol terminology.

Some C-Series controller models cannot be accessed on a subnetwork via a CV Bridge. Please refer to the Supported OMRON Devices section for information on which C-Series models are supported via a CV Bridge.

Enable — Set this check box to enable the device when the project starts. If you clear the check box, the device will not be enabled and points associated with the device will be unavailable.

Point Configuration

Once your devices are configured, you may configure points for them. Through device point configuration, you may configure the following:

- Points that read or set discretes and/or bits in memory
- Points to read or set CIO, LR, HR, AR and DM memory areas
- Points to read Timer/Counter completion statuses
- Points to read or set Timer and Counter Present Values (PVs)
- Points to read Status and Errors
- Points to set operation mode

The fields described below have configuration values that are unique to, or have special meaning for OMRON TCP/IP communications.

OMRON TCP/IP General Point Properties

On the General tab in the Point Properties dialog box, the type of **Access** you choose depends on the point address:

- Select **Read** for points configured for Error reading and Timer/Counter compilation statuses.
- Select **Read/Write** for all other points configured if you wish to be able to set (change) the value.

OMRON TCP/IP Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria

The update criteria determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by the OMRON TCP/IP driver at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by the OMRON TCP/IP driver at regular intervals while users are viewing them.

Address

Point address requirements are device-dependent. Valid device types are:

C-Series
CS1- Series
CV-Series

See the sections below for detailed information on the point address requirements for each device type.

When you configure BOOL points from non-discrete memory (such as CIO, HR or DM) you must also enter data in the following field:

Bit Offset

Enter the bit offset in the 16-bit memory word that defines the point where 0 is the least significant bit and 15 is the most significant bit.

Warning

Do not enter a data Bit Offset for Point Type BOOL for Timer and Counter Completion Statuses or Temporary Relay (TR).
Leave the field as the default 0.

Point Address Formats

Following are address formats for the OMRON TCP/IP series.

C-Series Point Addresses

For C-Series programmable controllers connected to the local Ethernet Network, the following formats are valid:

Memory Area	Address Entry
Core I/O (CIO)	000 to 255
Link Relay (LR)	LR000 to LR63
Holding Relay (HR)	HR00 to HR99
Auxiliary Relay (AR)	AR00 to AR27
Timer Completion Flag	TIM000 to TIM511
Timer PV	TPV000 to TPV511
Counter Completion Flag	CNT000 to CNT511
Counter PV	CPV000 to CPV511
DM Area	DM0000 to DM9999
Status	ST
Error Read w/ Clear	EC0, EC1
Error Read w/o Clear	ER0, ER1

CS1 series Point Addresses

For CS1-series Programmable Controllers connected to an Ethernet Network, the following formats are valid:

Memory Area	Address Entry
Core I/O (CIO)	0000 to 6143
Aux Relay (A)	A000 to A959
Holding Relay (HR)	HR000 to HR511
Work Relay (WR)	WR000 to WR511
Timer Completion flag (TIM)	TIM000 to TIM4095
Timer Present Value (TPV)	TPV0000 to TPV4095
Counter Completion flag (CNT)	CNT000 to CNT4095
Counter Present Value (CPV)	CPV0000 to CPV4095
Task Flag (TK)	TK00 to TK31
Index Register (IR)	IR00 to IR15
Data Register (DR)	DR00 to DR15
Data Memory Area (DM)	DM00000 to DM32767

Expansion Data Memory Area (E)	E00000.b to E32767.b where b is the bank number

CV-Series Point Addresses

For CV-Series programmable controllers connected to the local Ethernet Network, the following formats are valid:

Memory Area	Address Entry
Core I/O (CIO)	000 to 255
Temporary Relay (TR)	TR0 - TR7
CPU Bus Link Area (G)	G000 to G255
Auxiliary Area (A)	A000 to A511
Timer Completion Flag	TIM000 to TIM1023
Timer Present Value (PV)	TPV0000 to TPV1023
Counter Completion Flag	CNT000 to CNT1023
Counter Present Value (PV)	CPV0000 to CPV1023
DM Area (DM)	DM00000 to DM24575
Expansion DM (E)	E00000.b to E32765.b where b is the bank number (CV-Series Ext. only, CV1000, CV2000, CVM1-CPU11-E,…)

Notes on Addressing

Please note the following about point addresses for the OMRON device communications enabler:

- Letters in address entries can be upper or lower case
- Leading zeros on address numbers are optional. Example: HR003 is treated the same as HR3.
- Address ranges may be limited by the address space available in the controller device.
- The Error Read w/ Clear and Error Read w/o Clear memory areas are read only - Do not configure points with these addresses as setpoints. Refer to the C-Series Ethernet Units manual for details on these memory areas.
- You can use a Status (ST) point as a setpoint to set the operating mode of the controller. When reading Status, the status data from the Status Read response is returned. This data is different from the data written. Refer to the C-Series Ethernet Units manual for details on Status Read and Status Write.
- Use BOOL Point Types for Completion flag (TIM and CNT) and Temporary Relay (TR) points.
- Status (ST), Error Read w/ Clear and w/o Clear are not accessible when you communicate with the programmable controller via a CV bridge.

Adjusting the Communications Time-out Parameter

The communications time-out parameter used by the OMRON TCP/IP communications enabler is set to a default value of 7.5 seconds. You can change this parameter in CIMPLICITY software. To do this, add the following record to the Global Parameters file:

```
<port>_TO|1|<value>
```

where **<port>** is last six characters of the communication TCPIP port number assigned when you defined the port in the CIMPLICITY HMI project and **<value>** is the time out in *tenths* of seconds. For example, if the port assigned when you defined the port in the project is MASTER_OMTCP0, then the entry would look like the following:

```
OMTCP0_TO|1|105
```

sets the time out for communications to 10.5 seconds.

For more information on configuring global parameters, see Global Parameters in the *CIMPLICITY Base System User Manual* (GFK-1180).

Setting Required Protocol Parameters

Three communication parameters can be set via the CIMPLICITY projects global parameters that define information about the computer on which the CIMPLICITY project is running. These values become part of the FINS structure for each transmitted command allowing the controller responses to find their way back to the enabler. One of the parameters (SNA) has a default, which if acceptable need not be changed. The others, (SA1 and Service Name) are required in order for the OMRON Ethernet device communication enabler to operate. These three parameters act as a *return address* and must be defined properly or you will receive time-out error messages even though the controller(s) are responding.

The three parameters are:

Parameter	Value Range and Description
SNA	This is the network number assigned to the Ethernet network in the OMRON Ethernet module setup. The SNA entry need not appear in the global parameters if the default is acceptable. Valid values are: 0 = Local network (default) 1 through 127 = Remote network
SA1	This is the Source Node Number for the computer initiating the communication. See Application Notes for information on how this is used. Valid values for the Source Node Number are: 1 through 126
Service name	This corresponds to an entry in the operating system's **`services`** file. The entry relates the name to a UDP port number for which the OMRON Ethernet Units have been configured.

To define these parameters, add the following records to the Global Parameters file:

```
<port>_OMRON_SNA|1|<value>
<port>_OMRON_SA1|1|<value>
<port>_OMRON_SERVICE|1|<value>
```

where **<port>** is last six characters of the communication TCP/IP port number assigned when you defined the port in the CIMPLICITY project. **`<value>`** is either the SNA value the SA1 value or the service name per the descriptions in the above table. For example, if the port assigned when you defined the port in the project is MASTER_OMTCP0, then these entries:

```
OMTCP0_OMRON_SNA|1|3
OMTCP0_OMRON_SA1|1|15
OMTCP0_OMRON_SERVICE|1|omron_service
```

set the SNA to 3, the SA1 to 15, and the Service Name to **`omron_service`**.

For more information on configuring global parameters, see Global Parameters in the *CIMPLICITY HMI Base System User Manual* (GFK-1180).

Default Protocol Parameters

Certain protocol parameters used by the OMRON TCP/IP communications enabler have been preset. They are:

Parameter	Value	Description
DA2	0	Unit Address - 0 indicates the programmable controller's CPU. This is not the same as the unit number (that is, node number) which is configurable.
SA2	FE	Source of communication unit
SID	FF	Service ID.

Technical Support Worksheet

Please complete and review the following information before contacting technical support if you are unable to establish communications with a controller.

CIMPLICITY Project Information

Enter the following information about the CIMPLICITY project that uses OMRON TCP/IP communications:

The IP address for the computer running the CIMPLICITY project: _____

The netmask setting for your Ethernet network. This determines the network "class". Also referred to as the subnet mask. _____

The SNA value defined via the global parameter file (if the default of zero is over ridden). _____

The SA1 value defined via the global parameter file. _____

Host name assigned to the target controller or the controller acting as a gateway if the target is on a subnetwork. _____

The DNA value entered for the target controller. This is the **<subnetwork number>**. _____

The DA1 value entered for the target controller. This is the **<address>**. _____

Complete entry for the address of the controller in the **Address** field of the *Default* properties page in the *Device Configuration* dialog box. _____

Make sure you have printouts of the following files on hand:

- The operating system's **services** file.

  Locate the service name used to get the UDP Port Number for binding the communication socket and the Service Name defined for project.

- The **hosts** file.

  Locate the Host Names and IP addresses for the controllers with which you will be communicating.

- The **glb_parms.idt** file.

  Locate any global parameters you defined for OMRON TCP/IP communications.

OMRON Ethernet Module Configuration Information

If the targeted controller is not connected to the Ethernet directly but is on a subnetwork, then provide the following information on the CV controller connected to the Ethernet network that is acting as a gateway:

The IP address configured for the module _____

The subnet mask configured for the module. _____

UDP FINS Port Number configured _____

Type of IP address conversion configured, table lookup or automatic address generation. _____

Node Number Rotary Switch setting. _____

The SA1 value defined via the global parameter file. _____

Targeted OMRON Controller Information

For each targeted OMRON controller, get the following information:

The destination network address (DNA). _____

The destination node number (DA1) _____

Routing table configured for gateway (if target is not connected to Ethernet) _____

Testing Results

Run **`ping`** and have information about the following on hand:

- Results from performing a **`ping`** to the controller's IP address (for example, **`ping 130.0.25.43`**).
- Results from performing a **`ping`** to the host name (for example, **`ping controller_1`**).

Run the *OMRON TCP/IP Diagnostics* program and have information on hand about field settings test results and any error messages displayed in the dialog box.

Status Log Messages

Check the *Status Log Viewer* for the following:

- Any messages displayed in the *Status Log* as the OMRON TCP/IP communications enabler starts or tries to start.
- Any messages displayed in the *Status Log* as the OMRON TCP/IP communications enabler tries to communicate to devices.

In addition, have printouts of the relevant messages on hand.

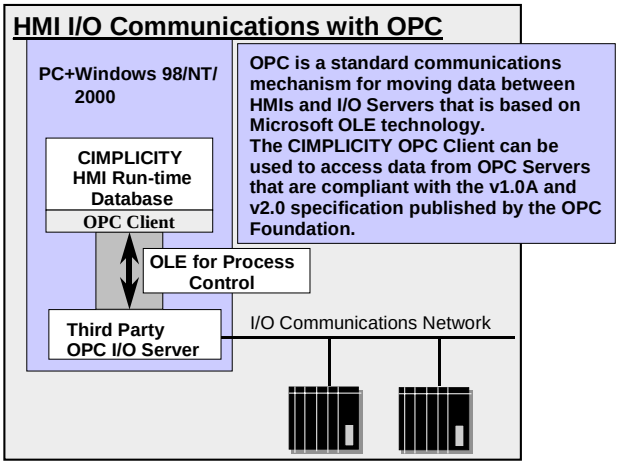
OPC Client

OPC Client Overview

CIMPLICITY OPC Client software provides CIMPLICITY users with access to process data from OPC servers.

OPC (OLE for Process Control) is an emerging standard that is rapidly gaining acceptance among vendors of HMI and process automation products in response to the complexities of interoperability among industrial control vendors. Developed by the OPC Foundation and endorsed by Microsoft, OPC can provide lower costs and increased productivity for end-users, systems integrators, and process control vendors alike by focusing communications issues on a single technology and strategy. Like CIMPLICITY® HMI, OPC builds on the success and strength of Microsoft® Windows 2000®, Microsoft® Windows NT®, Windows® 98, and OLE (Object Linking and Embedding) technology.

OPC defines a single common interface for both C++ and Visual Basic programs and is based on Microsoft's Component Object Model (COM) and the Distributed Component Object Model (DCOM). Through this interface, software as diverse as Microsoft BackOffice™, HMI, and custom Visual Basic applications will be able to access process data using the same methods.


HMI I/O Communications with OPC
PC+Windows 98/NT/ 2000
CIMPLICITY HMI Run-time Database
OPC Client
OLE for Process Control
Third Party OPC I/O Server
I/O Communications Network
OPC is a standard communications mechanism for moving data between HMIs and I/O Servers that is based on Microsoft OLE technology.
The CIMPLICITY OPC Client can be used to access data from OPC Servers that are compliant with the v1.0A and v2.0 specification published by the OPC Foundation.

The OPC Client supports the following CIMPLICITY features:

- Collection of unsolicited data from an OPC Server.
- Poll after setpoint.
- Triggered reads.
- Analog Deadband via CIMPLICITY filtering

This enabler supports the following data types:

- Boolean
- Signed 8, 16, and 32 bit integers.
- Unsigned 8, 16, and 32 bit integers.
- Floating point
- Text.

Supported OPC Servers

OPC Servers provide real time data by firing events whenever the value (or quality) of an item (added by the OPC client) changes. This 'OnDataChange' event is defined by the OPC specification. An OPC Client can subscribe to this event and provide a **`handler`** function that gathers the new item values whenever the OPC Server fires the **`OnDataChange`** event.

The event handlers for gathering incoming unsolicited point updates in the CIMPLICITY OPC Client are compliant with the OPC 1.0 and 2.0 Data Acquisition specifications. The OPC Client tests to see if it has connected to a 1.0 or 2.0 compliant OPC Server and sets up the proper event handler for optimum performance.

Specifically, the CIMPLICITY OPC Client makes use of the following methods exposed by an OPC Server (per the OPC 1.0 and 2.0 Data Acquisition specification):

Interface	Specification	Details (methods)
IOPCServer	Required in DA 1.0 Required in DA 2.0	This is the main OPC Server interface. The following methods are used:: ▪ **`GetStatus`**: This method is used to 'ping' the OPC server. ▪ **`GetGroupByName`** ▪ **`AddGroup`** ▪ **`RemoveGroup`**
IPersistFile	Optional in DA 1.0 Optional in DA 2.0	If the OPC server provides this interface, and a persistent file is specified in the Device Address field (see Device Dialog Box Default Tab below), these methods are called: ▪ **`Load`** ▪ **`Save`**
IOPCItemMgt	Required in DA 1.0 Required in DA 2.0	The following methods of the Item Management interface are called: ▪ **`AddItems`** ▪ **`RemoveItems`**
IOPCSyncIO	Required in DA 1.0 Required in DA 2.0	These methods are used to read values from and write values to the OPC Server: ▪ **`Read`** ▪ **`Write`**

IOPCAsyncIO	Required in DA 1.0 Optional in DA 2.0	**Refresh:** Instructs the OPC Server to fire an **OnValueChange** event for all items in a Group.
IOPCAsyncIO2	Undefined in DA 1.0 Required in DA 2.0	**Refresh2**: Instructs the OPC Server to fire an **OnValueChange** event for all items in a Group.
IDataObject	Required in DA 1.0 Optional in DA 2.0	This interface provides the *old* way to subscribe to the **OnDataChange** event. ▪ **DAdvise**: Subscribe ▪ **DUnadvise**: Unsubscribe
IConnectionPointContainer	Undefined in DA 1.0 Required in DA 2.0	This interface provides the 'new' way to subscribe to the OnDataChange event. ▪ **FindConnectionPoint**
IConnectionPoint	Undefined in DA 1.0 Required in DA 2.0	This interface provides the *new* way to subscribe to the OnDataChange event. ▪ **Advise**: Subscribe ▪ **Unadvise**: Unsubscribe

Supported OPC Client Types

The following types are supported by this communications interface:

Analog

3D_BCD	Positive BCD values ranging from 0 to 999.
4D_BCD	Positive BCD values ranging from 0 to 9999.
DINT	Integers ranging from -2,147,483,648 to + 2,147,483,647.
INT	Integers ranging from -32,768 to +32,767.
REAL	Floating-point numbers.
SINT	Integers ranging from -128 to +127
UDINT	Unsigned integers ranging from 0 to 4,294,967,295.
UINT	Unsigned integers ranging from 0 to 65,535.
USINT	Unsigned integers ranging from 0 to 255.

Boolean

BOOL	A one digit Boolean point with a value of 0 or 1.
BYTE	An 8-bit array of Boolean points.
WORD	A 16-bit array of Boolean points.
DWORD	A 32-bit array of Boolean points.

Text

STRING	A one-character alphanumeric.
STRING_20	A 20-character alphanumeric string.
STRING_8	An 8-character alphanumeric string.
STRING_80	An 80-character alphanumeric string.

The OPC Client supports all CIMPLICITY data types. The target OPC Server must also support the same data types. Since some servers implement strict type checking, it is recommended that you check the OPC Server documentation for data types supported by any OPC Server.

Points may be single elements or array points if the OPC Server supports the configuration.

It is important to note that OPC specification (both 1.0 and 2.0) does *not* provide for passing arrays of data. It does *not* define how an OPC Server should pass array data to an OPC Client. With that said, some OPC Servers provide a way of defining Visual Basic (VB) style arrays (usually by appending an element count onto the Item ID). How arrays are supported, if they are supported, is specific to the OPC server. Consult your OPC Server vendor for details.

If an OPC Server does support VB style arrays, they can be configured in the CIMPLICITY OPC Client by simply setting the number of elements under Point Properties to match the number of elements defined in the Item ID (the CIMPLICITY point address).

Note that these values must match.

Example

If the array is defined by the syntax **MyItem_20**, indicating a twenty-element array, then the **Elements** property of the Point Properties in CIMPLICITY must also be set to 20 or the array will not be successfully retrieved from the OPC Server.

OLE passes the array within a single Variant value. Therefore, it is not possible to read or write a single element. The entire array must be passed when reading from the OPC Server or writing to the OPC Server.

The following three point addresses can be used in conjunction with the Diagnostic checkbox on the Device tab of the Point Properties dialog box. The point ID can be anything that makes sense. The point address should be the values provided below, and the Diagnostic checkbox must be checked. These points may be configured for each CIMPLICITY device configured.

$OPC_SERVER_STATUS	Read Only Must be configured as SINT or USINT	Will be one of the following values: **OPC_STATUS_RUNNING** = 1 **OPC_STATUS_FAILED** = 2 **OPC_STATUS_NOCONFIG** = 3 **OPC_STATUS_SUSPENDED** = 4 **OPC_STATUS_TEST** = 5
$OPC_FORCE_REFRESH_NOW	Read / Write Must be configured as SINT or USINT	Writing a non-zero value to this diagnostic point instructs the OPC Client to call the Refresh method for all groups in the OPC server. This instructs the server to send *all* point values (changed or not). The value displayed will: ▪ Not reflect the written value ▪ Always display zero. An entry is written to the status log indicating that the command was received.
$OPC_FORCE_DISCONNECT_NOW	Read / Write Must be configured as SINT or USINT	Writing a non-zero value to this diagnostic point instructs the OPC Client to abort the connection with the OPC server then re-establish it. **Important:** Use of this diagnostic is **not recommended!** Well-behaved OPC Servers simply do not need it. Using this diagnostic can leave the OPC Server in a bad state. After using this diagnostic, it is likely that the OPC server will not shut down properly once the project is stopped.

OPC Client Hardware Configuration Requirements

All hardware requirements are OPC Server specific. OPC Client Related Documents

You should have the following documentation available when configuring this interface:

OPC Server Manual

OPC Product Specification version 1.0A (optional)

OPC Product Specification version 2.0 (optional)

OPC Client Configuration Checklist

Prior to using this communication interface, you *must* do the following:

1. Install OPC Server (and proxy if on different machine) as detailed in the OPC Server manual.
2. Configure the OPC Server as detailed in the OPC Server manual.

OPC Client Application Configuration.

You will be asked for some information that is specific to OPC Clients when you configure:

- Ports (*next*),
- Devices. *See page 21 -9.*
- Device points. *See page 21-13.*

Configuring the OPC Client Port

To create a new port for OPC Clients, you enter the information in the

- New Port dialog box .
- General tab of the Port Properties dialog box.

New Port Dialog Box

To create a new port:

1. Do one of the following:

   Method 1

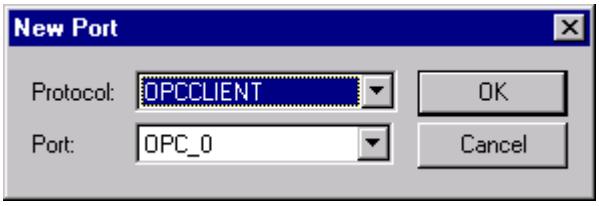
   Click the **Ports** icon in the Workbench left pane.

   Method 2

   A. Click File on the menu bar.

   B. Select New.

   The New Port dialog box opens when you use either method.
2. Select OPCCLIENT in the Protocol field.
3. Select the port for the protocol in the Port field.

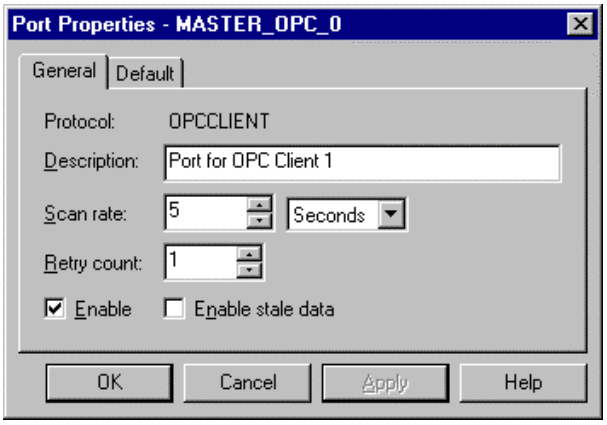


3. Click **OK** to create the port.

   Result: The Port Properties dialog box for the protocol opens.

Port Properties Dialog Box

The OPC protocol you selected in the New Port dialog box appears in the General tab of the Port Properties dialog box. Enter information that pertains to that protocol in this tab.



Enter the following information in the General tab of the Port Properties dialog box.

Description	Optional
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify a scan rate in Ticks (100 ticks = 1 second), Seconds, Minutes, or Hours. **Note:** This scan rate only applies to points that are not configured with an **`unsolicited`** or **`unsolicited on change`** update criteria. **Note:** This value does not define how often the OPC Server polls its hardware. It only defines how often CIMPLICITY polls the OPC Server. See the **`Scan Rate`** variable in the .ini file for more information.
Retry Count	If communications cannot be established to a device on this port, the device is considered to be down. For polled communication only, this is the number scans until polled communications is attempted in the absence of the receipt of unsolicited data.
Enable	Set this check box if you want the port to be enabled when the project starts. Enabling and disabling t port only affects polled communication. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Enable stale data — Set this check box if you want to enable stale data. If you check the box, this means you want the point values to remain available under most circumstances that would have made them unavailable. Under these conditions, the values displayed will be the last known value for the point. Since the current values are unknown, the values may or may not represent the current values on the device.

Important: The Default tab of the Port Properties dialog box requires NO configuration for the OPC Client.

Configuring an OPC Client Device

To create a new Client Device configuration for OPC Clients, you enter the information in the:

- New Device dialog box
- General tab of the Device dialog box
- Default tab of the Device dialog box.

New Device Dialog Box

To create a new device:

1. Do one of the following:

   Method 1

   Click the **Devices** icon

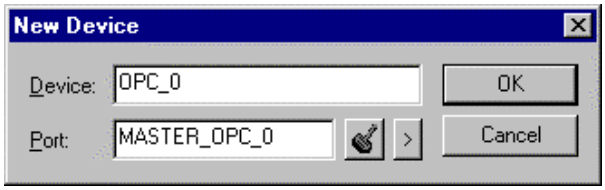
in the Workbench left pane.

   Method 2

   A. Click File on the Workbench menu bar.

   B. Select New.

   The New Device dialog box opens when you use either method.



2. Fill in the two fields.

   Device — Enter a name for the device you are configuring.

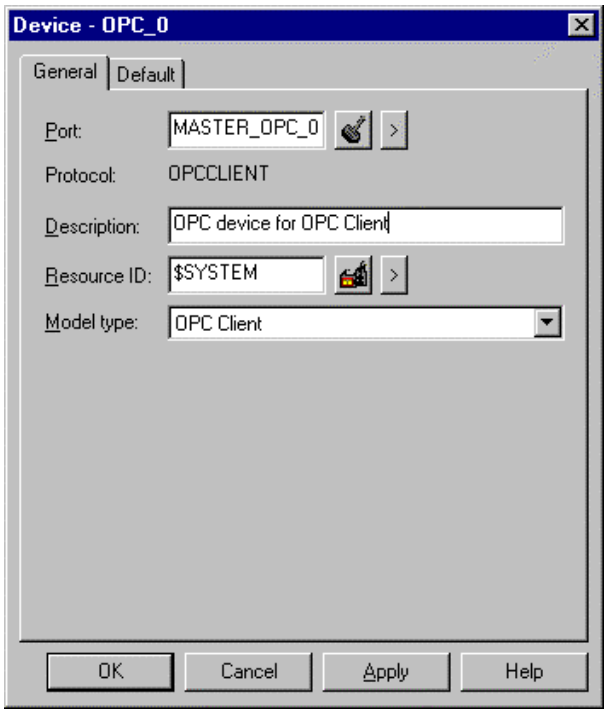
   Port — Select the OPC Client port to be used by the device.

3. Click **OK**.

Result: The Device dialog box opens.

Device Dialog Box General Tab

When you create a new device, the Device dialog box opens displaying the OPC protocol associated with the port you selected in the New Device dialog box.

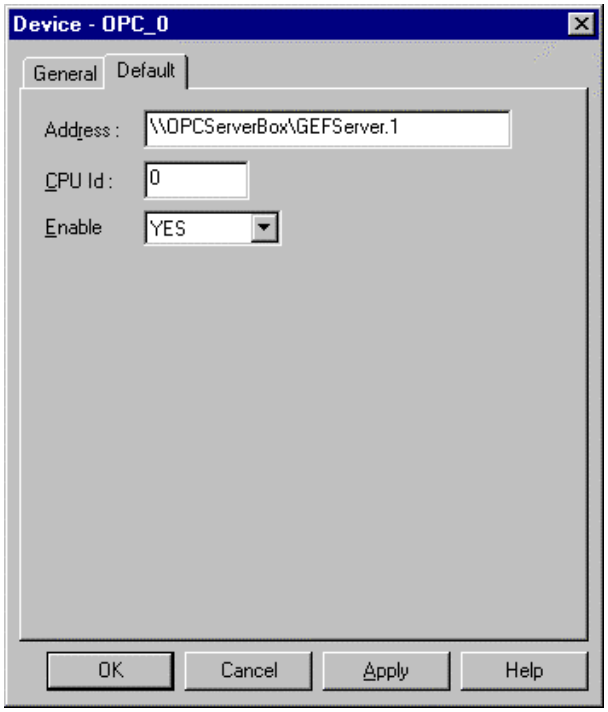


Enter information on the General tab in the Device dialog box as follows:

Port	Select the port for this device if it is different from the port that displays. The protocol will change to reflect protocol that is associated with the port you select. Click to the right of the field to display the list of ports and select one. Click to create a new port, edit the current port, or select a port from the list of ports.
Description	Enter an optional description to help you identify the device.
Resource	Enter a resource that can be associated with this device for alarm generation. Click to the right of the field to display the list of resources and select one. Click to create a new resource, edit the current resource, or select a resource from the list of resources.
Model Type	Always select the OPC Client.

Device Dialog Box Default Tab

Default device information is required for the OPC configuration.



Enter specific information on the Default tab in the Device dialog box as follows:

Address

The Device Address field is used to specify up to four pieces of information. The four pieces of information specified in the Device Address field are (in order):

Remote Machine Name (*Optional*)

OPC Server Application ID (*Required*)

Access Path for device (*Optional*)

Server Configuration File (*Optional*)

Note: The only requirement is the OPC Server's application ID. This is specific to the OPC Server, and should be documented by the OPC Server's manufacturer.

Example

We will use GE Fanuc Automation's OPC Server, which has an application ID as follows:

```
OPCServer.1
```

If:

The OPC Server resides on a different computer than the CIMPLICITY project, you must specify a Remote Machine Name. The Remote Machine Name MUST be:

- Preceded by two backslashes, and
- Have a trailing backslash.

If the OPC Server resides on a computer named: OPCServerBox, the Device Address field would look like this:

\\OPCServerBox\OPCServer.1

If:

The OPC Server requires an Access Path to reference a particular device, the Access Path will follow the application ID, separated by a semi-colon.

Example

If the Access Path to the device we are configuring is: Box01.Device01.Slave01, the Device Address field would look like this:

\\OPCServerBox\OPCServer.1;Box01.Device01.Slave01

If:

The OPC Server uses the OLE interface IpersistFile to load a configuration file, the name of this configuration file will follow the Access Path, separated by a semi-colon.

Example

Of the configuration file is named: `ServerConfig.dat`, the Device Address field would look like this:

\\OPCServerBox\OPCServer.1;Box01.Device01.Slave01;ServerConfig.dat

If:

You wish to specify a Server Configuration File, but not an Access Path, you may leave the Access Path field empty. Be sure to provide the correct number of semi-colons, like this:

\\OPCServerBox\OPCServer.1;;ServerConfig.dat

CPU ID — This field is *not* used by the OPC Client

Enable — Select YES to enable this device when the project is started. Select NO to disable this device when the project is started.

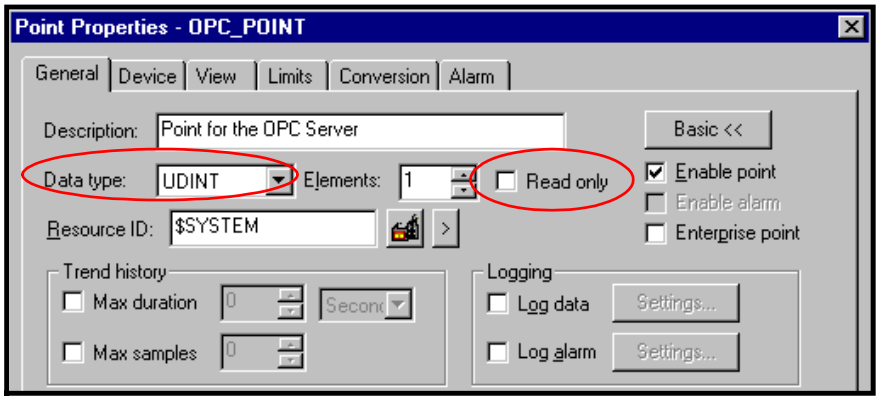
Configuring OPC Client Points

Once your devices are configured, you may configure points for them. You do this through the *Point Configuration* window. *See the chapters about point configuration in the Base System User's Manual (GFK-1180) for detailed information about point configuration.*

Configuration in the Point Properties dialog box that is specific for the OPC Client is on the:

- General tab and
- Device tab.

Point Configuration Dialog Box General Tab



When you configure a new point in the Point Properties dialog box, entries on the General tab that apply particularly to the OPC configuration include the following.

- You may configure points for:
  - ➔ Read only (check Read only) or
  - ➔ Read/Write (uncheck Read only) access.
- When you select the Point Type for the point, the validity for Point Type is determined by the OPC Server with which the OPC Client is communicating.

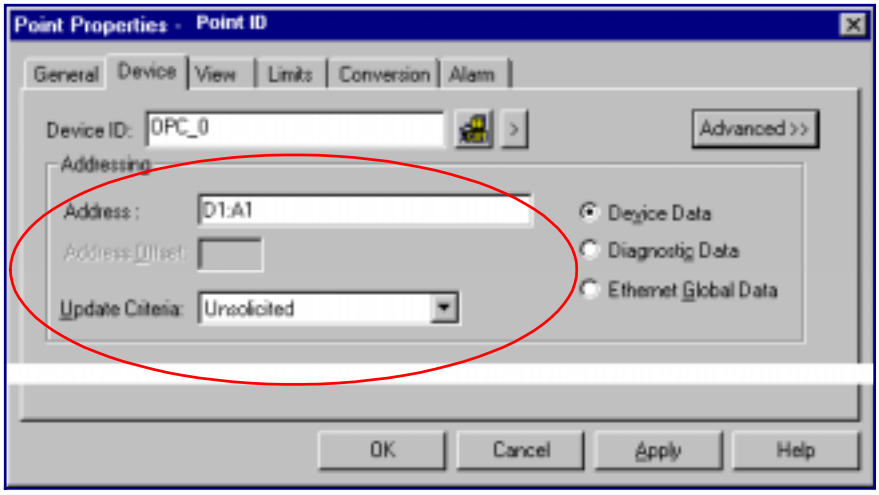
  If the point is rejected by the OPC Server because the requested point type is not valid:

  - ➔ CIMPLICITY will declare the point as invalid.
  - ➔ The OPC Client will log a message to the Status Log indicating that the point was rejected because the point type was invalid.

  In some OPC Servers, points that are configured within the OPC Server may be one of several *allowed* point types.

Check your OPC Server documentation! The more familiar you are with your OPC Server, the easier it will be to configure points successfully.

Point Properties Dialog Box Device Tab



Fill in the following information on the Device Tab of the Point Properties dialog box.

Update Criteria

The update criteria determine how the data will be requested.

- By default, **`Unsolicited`** or **`Unsolicited On Change`** may be selected as the Update Criteria. The OPC Server will performing the polling operation and notify the OPC Client of the configured values that have changed. Additional characteristics that affect the data collection are configured within the group to which the point is assigned. *See guidelines for configuring group addresses below.*

Address

The Address field may:

- Contain up to 256 characters.
- Include the OPC Group name or Item ID, and the Item name. *See guidelines for configuring group addresses below.*

OPC servers may:

- Require points to be pre-configured in the server before they can be accessed by a client or
- Allow points to be dynamically added by the client.

The address for the point is OPC Server specific. Consult the OPC Server's manual for addressing information.

Guidelines for configuring group addresses:

1. You do not need to specify a group in the Address field.

   If you do not specify a group, CIMPLICITY puts the point into one of two default groups, based on the point's Update Criteria.

Default Group	For points with Update Criteria that is:
DEFAULTPOLL	Polled
DEFAULTUNSO	Unsolicited

2. You can include a point in a group by using the following syntax in the Address field.

   `$[`*MYGROUP1***`]PointAddress`**

   Where

`$[`*MYGROUP1***`]`**	Defines the group into which the point is being placed.
`Point Address`	Is the address that is entered even if a group is not specified.

   Example

   ```
   $[MYGROUP1]D1:AI
   ```

   Note: If all of the points in a group have polled update criteria, CIMPLICITY treats the group the same way it treats `DEFAULTPOLL`. As soon as one point has unsolicited update criteria, CIMPLICITY treats the group the same as it treats `DEFAULTUNSO`.

3. A group name can be up to 16 characters.

4. An OPC Client can have up to 510 groups. Two groups are defined by default, leaving 508 possible user defined groups. The default configuration **`.ini`** file defines one user group. This may be deleted if desired, but **`DEFAULTPOLL`** and **`DEFAULTUNSO`** should not be deleted.

   No more than 32,767 points may be configured in each group for proper operation.

   Please note that configuration restrictions may exceed practical limits for project implementation.

OPC Client Unsolicited Data

Unsolicited data is supported for the OPC Client interface.

DCOM Overview

The OPC device communications enabler for CIMPLICITY is based on Microsoft's Object Linking & Embedding (OLE) model. OLE, in turn, was based on a specification for application architecture called the Component Object Model (COM).

COM is a method of writing a software application–a design model. Its most basic principle is that instead of writing an application as one large mass of code, the application should be broken down into independently running parts that each performs a specific function within an application.

In addition, COM specifies exactly how these components will interact with one another to form the whole application. This is known as the component's interface. The interface is actually a set of functions within the component, which other components can call from outside the component. These functions are *exposed* to the outside world. Any other component can call these functions to tell the component to do something, or ask it for some result. When a component exposes functions that anyone can call, it is called an OLE Server. Any other component calling an interface function is that server's OLE Client.

Each component is actually a program, running on the computer that may have exposed interfaces. The component program might do a variety of functions including things like displaying a chart, data collection from a PLC via a serial port, etc. Another program such as an HMI could then access the data through the exposed set of interface functions. This is the basic relationship between an OPC Server, and the CIMPLICITY HMI OPC Client communications enabler.

Distributed COM is exactly the same principle as COM, with one important difference. The OLE Server component, instead of just serving up functions to other components running on the same computer, can serve up functions to other components running on ANY computer on the network. Using DCOM, the CIMPLICITY HMI OPC Client can talk to OPC Servers running anywhere on the network.

There are some basic requirements and some configuration necessary to make this happen successfully.

See the "CIMPLICITY HMI OPC Server and DCOM" section in the CIMPLICITY OPC Server Operation Manual, GFL-1675 for details about DCOM setup.

Requirements for Distributed COM

For reliability, security, and ease of configuration, both nodes, that is the node where CIMPLICITY is installed, and the node where the OPC Server is installed, should be running the Windows NT 4.0 or Windows 2000 (or higher).

The OPC Server software must be properly installed and registered, and the CIMPLICITY OPC Client device communications enabler must be properly installed within CIMPLICITY HMI.

CIMPLICITY and OPC Server Nodes' DCOM Setup

Important: DCOM settings for the OPC Server must be setup properly for the system to work as required. This includes setting up the OPC Server to allow access by the OPC Client as well as impose restrictions consistent with your site's security guidelines and practices.

When the OPC Server is located on a different computer from CIMPLICITY, it is essential that that the network be operating within its designed capacity for reliable and that it be free of anomalous behavior in order for the OPC Communication to be reliable with good performance. This suggestion is true for any application that uses DCOM. This recommendation is not specific to CIMPLICITY**.**

You will need to be familiar with Microsoft's DCOMCNFG utility in order to configure the DCOM settings.

For additional information on DCOM Settings see the section Using CIMPLICITY HMI OPC Server User Interface in the CIMPLICITY OPC Server manual.

Optional OPC Client Debug Tracing

The OPC Client includes the ability to enable tracing in order to help diagnose problems in the communication between the OPC Client and OPC Server. Tracing is enabled/disabled on a project-by-project basis and is disabled by default.

Important: Enabling tracing will reduce the performance of your OPC Communication and your PC.

The supported levels of tracing include:

Level	Enables Tracing
OPC_TRACE_ALL	For all levels of tracing.
OPC_TRACE_CONNECT	For actions related to the management of the connection with the OPC Server.
OPC_TRACE_VALIDPOINT	For actions related to the validation of point configuration. The OPC Client informs the OPC Server of each configured point's address and type. The process for sending the information to the OPC Server is often referred to as *Adding the items to the Server*.
OPC_TRACE_READPOINT	Related to reading data from the OPC Server. (Polled requests)
OPC_TRACE_READERRORS	Related to errors encounters in read operations for items from the OPC Server. (Polled requests)
OPC_TRACE_WRITEPOINT	Related to writing values (setpoint operations) for items to the OPC Server.
OPC_TRACE_WRITEERRORS	Related to errors encountered when writing values for items to the OPC Server (setpoint operations)
OPC_TRACE_UNSOLICITED	Related to the receipt of item data from the OPC Server. Points that are configured with unsolicited update criteria are added to the OPC Server and Advised (meaning that the OPC Server is requested to notify the OPC Client when the item value or quality has changed). This level of tracing logs information related to the receipt of the advised data from the OPC Server.

Enabling Tracing

Placing an entry in the Global Parameters (**GLB_PARMS**) database enables tracing for each of the sections. As with any modification of the **GLB_PARMS** database, your project must be stopped, updated, and then restarted after the modification is made.

The record format for the global parameter is:

OPC_TRACE_<*section*>**|1|**<*value*>

where <*section*> is one of the following OPC sections:

CONNECT

VALIDPOINT

READPOINT

WRITEPOINT

UNSOLICITED

READERRORS

WRITEERRORS

ALL

and where <*value*> is one of the following:

YES – enables tracing

NO – disables tracing

To enable Tracing:

1. Open the project that uses the OPC Client in the CIMPLICITY Workbench.
2. Expand the Advanced folder in the Workbench left pane.
3. Expand the Global Parameter folder.
4. Select the Project folder.
5. Add or change the global parameter for Connect Tracing:
   OPC_TRACE_CONNECT|1|YES
6. Stop the project.
7. Update the project configuration.
8. Restart the project.

For more information on adding or changing global parameters, see the Global Parameters chapter in the CIMPLICITY HMI Base System User's Manual

Note: You can enable any of the sections you need. In the example above, we only enabled Connect Tracing. Also note that to **Disable Tracing** for a certain section, follow the procedure above, but change the **YES** in step 5 (5), to a **NO**. It is not necessary to remove the lines of text.

Viewing Trace Information

While tracing, the CIMPLICITY OPC Client will log information to an ASCII text file in English. It may be viewed using any editor that can edit ASCII text including NOTEPAD. Some of the information included in the trace file is to help you diagnose problems in the communication. The file may also include some information for GEF support engineers in the event that technical assistance is required from GE Fanuc.

By default, trace output is sent to the circular

log (MASTER_OPC_x.LOG,

Where

x is the port number).

This may be changed via a configuration parameter in the **.ini** configuration file (see below) so that it goes to the process's .OUT file

OPC_x.OUT

Where

x is the port number).

Caution should be used when sending the trace information to the process's .OUT file as this file may continue to expand as long as the communication interface is running and there is available disk space. Please note: enabling tracing to the OUTPUT file has a greater impact on performance than logging to the circular log.

OPC Client .ini Configuration File

This OPC Client uses a classic Windows **.ini** file to support various configuration parameters. There is one **.ini** file per CIMPLICITY Port configured. The name of this **.ini** file is the same as the Process name of the port. In this case:

MASTER_OPC_0..ini for the first port,

MASTER_OPC_1..ini for the second port, etc.

These **.ini** files MUST reside in the DATA subdirectory of your CIMPLICITY project directory.

Below is a sample **.ini** file for the new OPC Client. It contains ALL of the parameters. Each is set to its DEFAULT value. That is, the value used if there were NO **.ini** file present, or if that parameter was not specified in an existing **.ini** file.

In addition to the "Port Level" parameters, this **.ini** file sets the parameters for two devices (DEVICE1 and DEVICE2) and two groups (MYGROUP01, DEFAULTPOLL, and DEFAULTUNSO). Each of the parameters in the first device and first group are fully commented.

Important: When OPC Servers are located on a different computer from CIMPLICITY, when the CIMPLICITY computer is heavily utilized or where the computer where the OPC Server is heavily utilized, it is often necessary to adjust the configured PingInterval and PingTimeout from their defaults of 5000 (5 seconds) and 3000 (3 seconds) respectively. Values of 15000 (15 seconds) and 10000 (10 seconds) may be more appropriate. This will mean that it will take much longer to detect an OPC Server failure.

```
; 20000427
; 20010619
; This INI file is for use by the OPC Client devcom provided with
; CIMPLICITY 4.0.10 or higher, and CIMPLICITY 5.0.3, and CIMPLICITY 5.5.0
;
; This file must reside in the DATA subdirectory of the project directory.
; There is one INI file per OPC port configured in the project.
; The name reflects the port's ID. For example MASTER_OPC_0.INI for the
; first port, and MASTER_OPC_1.INI for the second port configured, etc.
;
; The purpose of this file is to allow the user to manually configure the
; OPC Port, Devices, and Groups. Unlike the global parameters file (GLB_PARMS)
; where settings applied to all devices or groups, settings here apply only
; to the specified device or group.
;
; This SAMPLE FILE contains ALL of the possible parameters. These parameters
; are set to their DEFAULT VALUE! If this INI file is not present, or if
; a particular Device or Group is not specified by a [Section Header],
; then the default values are used!
;
; For typical BOOLEAN parameters, a value of 1 means TRUE/ENABLE.  A value of
; 0 means FALSE/DISABLE.
;
; NOTE that the OPC client always creates TWO GROUPS where ALL points are
; placed unless you configure them otherwise. These groups are named:
; DEFAULTPOLL and DEFAULTUNSO. You can set parameters for these groups
; as well as the groups you define.
;
; NOTE there are a couple of parameters that apply to the 'Port' as a whole.
; These are placed in the section called [PortLevel].
;
[PortLevel]
; Should CIMPLICITY treat REAL values as four byte (float) or 8 byte (double)
; If the OPC server sends float values, then setting this to one (1) will have
; no affect on precision. If the server sends doubles, setting this to one (1)
; will maintain the precision as the value is passed into CIMPLICITY.
EightByteReals=0

; Should CIMPLICITY use the timestamp passed from the OPC server...
; (or provide its own timestamp at the time the update is received)
UseServerTimeStamp=1

; Controls the rate in Ticks (1 tick = 1/100 seconds) that Windows Messages
; are pumped by the OPC client. While the client has no use for these messages,
; it is required by the OS to process them. By default, it drains the message
; queue once every half second.
; We have found that older STA (single threaded) OPC servers can be affected
; by this. If the OPC server is not firing events at the rate you are asking for
; (see ScanRate below), you can try lowering this value.
; Note that draining the messages queue takes away from processing incoming data!
; Lowering this value means the message queue is drained more often.
; Default value is 50.
MessageTicks=50

; By default, tracing is to a circular file.  If disabled, logging
; goes to the output file.
CircularLog=1

; Conversion of data types for many older servers was accomplished via a method
; called data type promotion. Because the VARIANT was not able to hold signed
; eight bit (SINT), unsigned sixteen bit (UINT), and unsigned thirty-two bit (UDINT)
; values, these types were 'promoted' to the next larger type that the VARIANT
; was capable of holding.
```

```
; As of Service Pack 4 for Windows NT, the VARIANT was redefined to allow these
; data types, making data type promotion obsolete.
; While newer OPC servers are making use of the new VARIANT types...
; MANY older OPC servers still expect data type promotion to occur.
; THIS INCLUDES THE CIMPLICITY OPC SERVER as of HMI 5.1.00!!!
; Since data type promotion is no longer typical, this parameter defaults to disabled.
UseDataTypePromotion=0

; Our OPC client calls the AsyncIO::Refresh method in the server whenever we
; (re)attach and add all the items to the server. This insures that we have
; an initial value for all unsolicited points. Many OPC servers do not
; require this because they detect a client 'Advising' and fire initial
; values at that point. Some OPC servers FAIL (return an error) when this
; method is called. In this last case, you may decide to set this option
; to FALSE (0) so our client does not attempt to make this method call.
RefreshUnsoItems=1

; Point by address points on a screen and 'Delayed Load' points are added
; to the OPC server one at a time. This has been the behavior until now,
; and remains the default behavior (this variable set to zero).
; If this is set to one [1], PBA and DL points are added in chunks for speed.
; The size of the chunks is determined by a new global parameter:DC_PTM_MSG_MAX.
BatchDynamicAdditions=0

; This option provides a way to override the DC_PTM_MSG_MAX global parameter
; without having to set the global parameter.
; The default value for this is fifty [50].
; Allowed values are from ten [10] to ten thousand [1000]
; Set this according to the number of points that might be placed into
; demand by any given screen within your application.
; NOTE: Even if the DC_PTM_MSG_MAX global parameter exists, this setting
;       will override it.
BatchAddBatchSize=50

; When BatchDynamicAdditions is TRUE (1), the OPC client relies on its
; parent process to tell it when dynamic additions begin, and when these
; additions have completed. Upon the 'completion' notification, the OPC
; client adds the 'batch' of items to the OPC server.
; In heavily loaded systems, it is possible for the 'completion' notification
; to be delayed or missed. In these cases, a timer in the OPC client will
; cause the batched points to be added without waiting (any longer) for the
; 'completion' notification. This variable determines how long the OPC client
; will wait for the 'completion' notification.
; The default value is two (2) seconds. The time is in TICKS (1/100th of a second)
BatchTimeToLive=200

[DEVICE1]
; Some OPC servers take extra time to load their own point databases.
; Often, points added to the server by our client are declared invalid
; because the server was not ready to process additions.
; This delay occurs AFTER the OPC server is started, but,
; BEFORE any points are added by our client.
; Value is milliseconds!
StartupDelay=0

; Some OPC servers take extra time, AFTER a client has added points,
; getting initial values for those points. If a POLL occurs too soon
; values with BAD QUALITY are provided. To avoid this, the Read Delay
; causes our client to hesitate AFTER adding points but BEFORE the very
; first POLL.
; Value is milliseconds!
ReadDelay=0
```

```
; Our OPC client now PINGs the OPC server on a regular basis.
; The Ping Interval determines how often this ping occurs.
; Value is milliseconds!
PingInterval=5000

; If the method call made by the Ping (IOPCServer::GetStatus) takes
; too long to return, our client declares a communication error.
; The Ping Timeout determines how long to wait for this method call.
; Value is milliseconds!
PingTimeout=3000

; If the following parameter is TRUE (1), our client will shut down
; (on project shutdown) WITHOUT releasing any references to objects
; in the OPC server. This is STRICTLY against the rules of OLE!!!
; However, it will allow the CIMPLICITY project to shut down in a
; minimum amount of time. The OPC server will most likely NOT shut
; down at all, since it will believe that our client is still attached!
AbortShutdown=0

; If the following parameter is TRUE (1), our client will access the
; local registry information to find the OPC server ID first. If the
; devcom fails to find the server information in local registry, it
; will then log warning message and search the information in the
; remote node. This parameter is used to resolve the multi-sessions
; issue
UseLocalReg=0

; After a ping fails, this is the number of milliseconds that the client
; will wait after detecting a lack of response from the server via a ping
; before it will force an abort of the connection
DCOMTimeoutThreshold=10000

; When a network connection is broken between the OPC client and server
; in a DCOM situation, the very next method call the client makes
; (usually a POLL [ISyncIO::Read]) can HANG for upwards of 90 seconds.
; This causes ALL device communication in CIMPLICITY to hang until the
; method call times out. By Pinging the OPC server immediately before
; the method call, our client can eliminate MOST of these potential
; DCOM timeouts (since Pinging occurs on a different thread).
; Note that this DOES add the overhead of an extra call to the server
; per poll request (or write request)... But with a DCOM timeout of
; 90 seconds... you may consider this well worth it!!!
PingBeforePoll=1
PingBeforeWrite=1

; The Client will by default establish a connection using OPC 2.0 methods if
; the Server will support it.  (It will use 1.0 if the server does not.)  To
; force the use of 1.0 methods, enable this variable.
ForceOPC1Server=0

; In Host Redundant environments, by default, the acting master will advise
; for the points that are defined to be  unsolicited/unsolicited on change/
; poll once/poll once on change  (i.e. the server polls the data and notifies
; the client only of those items that have changed). Some servers may be slow
; in collecting the data  resulting in transition times for the unsolicited
; data.  By, all data will be advised and refreshed (unless refresh is
; disabled) on host transition. Enabling this variable will result in both
; servers advising the client.  The result will be more traffic  both a
; lower transition time.  It is possible that data that changes during the
; transition between hosts may be lost for points with an unsolicited or
; unsolicited on change update criteria.
HRBothActive=0
```

```
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
; WARNING!!!!!!
; In adjusting the following 2  parameters, it may be necessary to adjust
; the amountof time the process manager waits for the process to shutdown.
; Call the  CIMPLICITY help desk if you need to adjust this parameter.
; Test out the configuration very thoroughly to ensure that if the values
; are increased, that the process manager is giving enough time for the
; OPCCLIENT to shutdown.
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;
; If server is slow, heavy load, etc. it may be necessary to change this
; parameter.  If set to zero, it will be equal to twice the PingTimeout
; Otherwise, the absolute time value will be used.  Time is in milliseconds.
PingShutdown=0
;
; For large configurations, it may take longer for the OPC Server to clean
; up its configuration.
; Time is in milliseconds
DeviceShutdown=10000

; Open Designer Simulator OPC Server Alternate Name
; Leave undefined unless the Open Designer Simulator and Server name changes
;OpenDesignerServer=DesignerSim

; In all releases of HMI 5.x, when the OPC server rejected a point based on
; requested data type, the OPC client would automatically re-add the item
; as VT_EMPTY. The OPC specification says that, in this case, the OPC server
; WILL NOT reject the point based on the requested type.
; Doing this was originally considered a 'convenience' to the user...
; Points that would otherwise be rejected by the OPC server are now accepted,
; and the VariantChangeType API call is used to 'coerse' the data into the
; proper type for CIMPLICITY.
; Customer experience has shown that this does NOT always yield the desired
; result! Due to the nature of the VariantChangeType API, proper 'coersion'
; is not always possible. In other words, the OPC server is often justified
; in rejecting a point based on the request data type.
; The default value of TRUE (1) is intended to provide behavior consistent
; with prior releases of the OPC client...
; HOWEVER, BE AWARE that future releases of the OPC client MAY CHANGE THIS DEFAULT!
; You should attempt to run your project with this variable set to FALSE (0).
; If points are rejected, then the OPC server disagrees with the point type
; configured in CIMPLICITY! You should investigate this and determine why.
ReAddAsEmptyOnBadType=1

[DEVICE2]
StartupDelay=0
ReadDelay=0
PingInterval=5000
PingTimeout=3000
AbortShutdown=0
PingBeforePoll=1
PingBeforeWrite=1
PingShutdown=0
DeviceShutdown=10000
ReAddAsEmptyOnBadType=1

[DEFAULTPOLL]
; This is the Scan Rate passed to the OPC server for this group.
; It tells the OPC server how often to update the items in this group
; with fresh device data. It also determines how often
; to fire DataChange events to our client.  The unit of measure is in
; milliseconds and the default value is 1 second.
; If you require faster value updates, ; you can decrease this value to a
```

```
; value as low as ZERO.  ZERO tells the OPC server to update values 'as fast
; as possible'.  For servers able to collect rapidly changing data very
; rapidly, in a DCOM environment, it is possible to send the data faster than
; can be supported by the hardware/operating system on a sustained basis.
; Caution is urged before setting this to a value of ZERO.
; NOTE: As the scan rate decreases CPU usage may rise (somewhat significantly)
; and a corresponding increase in network traffic may be observed in a DCOM
; environment
ScanRate=1000

; Some OPC servers (such as OMNISERVER) do not use the Access Path
; when adding points. Instead, the Access Path  must be pre-pended in
; front of the Item ID. Enabling this feature  allows these OPC servers
; to have the Item IDs include the access path, separated by a period.
NoAccessPath=0

; Some OPC Servers benefit from a delay before executing a REFRESH after
; adding all of the items
DelayBeforeRefresh=0


; For polled operations, the Client will retrieve required data from the
; Servers cache.  For other operations, (i.e. poll after set) by default, it
; will request that the OPC Server read the data from the device.  This can
; significantly affect performance where the functionality is fully
; supported.  To force all reads from the cache, disable this variable.  It
; is enabled by default.
DeviceReadAfterSet=1

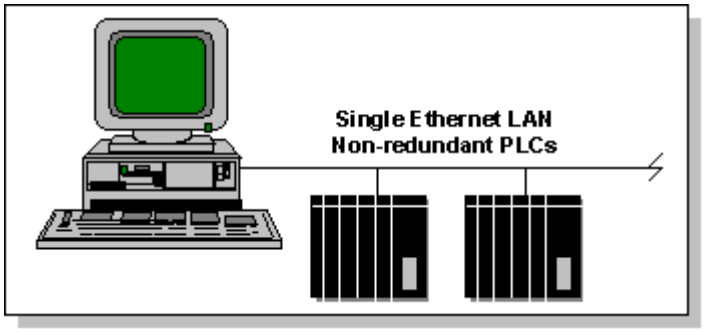
[MYGROUP01]
ScanRate=1000
DeviceReadAfterSet=1
NoAccessPath=0
DelayBeforeRefresh=0

[DEFAULTUNSO]
ScanRate=1000
DeviceReadAfterSet=1
NoAccessPath=0
DelayBeforeRefresh=0
```

Series 90 TCP/IP Communications

About Series 90 TCP/IP Communications

The Series 90 TCP/IP Communications enabler supports TCP/IP communication over Ethernet to Series 90-70 and 90-30 programmable controllers. This device communication enabler employs the Series 90 Host Communication Toolkit (HCT) as its underlying communication layer.



In addition, the Series 90 TCP/IP Redundancy Communications enabler supports various combinations of PLC and cabling redundancy.

This enabler supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Unsolicited data
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Series 90 TCP/IP Communication Requirements

The Series 90 TCP/IP Communication enabler has the following requirements:

Total Connections

The total number of connections allowed for CIMPLICITY Control, and all Series 90 TCP/IP and SNP Communication enablers is 64. You are allowed to run multiple Series 90 TCP/IP enablers.

Port to Use

All unsolicited points for the Series 90 TCP/IP Communications enabler need to be configured on the first TCP/IP port (TCPIP0). Unsolicited points on other ports will not be received.

Multiple Projects

If a port or device is used in more than one CIMPLICITY HMI project on a computer, then the configuration must be the same in both projects.

The file **`GEF_CFG.INI`** in the Windows directory contains the configuration data for the ports and devices. These files are shared by CIMPLICITY HMI projects and by CIMPLICITY Control.

Copying Projects Across Nodes

If a project is copied from one computer to another, then CIMPLICITY HMI software will attempt to merge the Port and Device configuration from the copied project into the global configuration file (**`GEF_CFG.INI`**) on the new computer. If a conflict is found then the current data on the new computer will not be changed.

For example, if a Device name is already being used but it has a different IP address then the project will connect to the wrong device. To correct this you will need to check the Port and Device configuration after copying the project.

Data Availability

The Ethernet Global Data Service (EGD Service) determines whether the global data it has on hand is current. Data that is not current is displayed as "unavailable" in CIMPLICITY software. This does *not* mean that the device is unavailable, just that the data available to the EGD Service is not current.

Conversely, if the device does become unavailable, EGD data does not become unavailable until the EGD Service determines that the data is not current.

Note: EGD is not supported on Windows 95.

Series 90 TCP/IP Supported Devices

The Series 90 TCP/IP Communications enabler currently supports the following devices:

- GE Fanuc Series 90-70 programmable controllers
- GE Fanuc Series 90-30 programmable controllers
- Ethernet Global Data producer devices

Series 90 TCP/IP Supported Memory Types

The Series 90 TCP/IP Communications enabler supports reading and writing point data to the Series 90-70 and Series 90-30 controllers.

Note

If you add a block to a programmable controller or resize domains, you must stop and restart the Series 90 TCP/IP Communications enabler in order for it to see the changes.

Data may be read from the following memory types:

Memory Type	Description	Memory Type	Description
%AI	Analog Input Table	%Q	Discrete Output Table
%AQ	Analog Output Table	%R	Register Memory
%G	Genius Seamless	%S	System Fault Table
%I	Discrete Input Table	%SA	Special Contacts A
%L	Local Memory *	%SB	Special Contacts B
%M	Discrete Internal	%SC	Special Contacts C
		%T	Discrete Temporary

* %L may only be used on Series 90-70

Data may be written to the following memory types:

Memory Type	Description	Memory Type	Description
%AI	Analog Input Table	%L	Local Memory *
%AQ	Analog Output Table	%M	Discrete Internal
%G	Genius Seamless	%Q	Discrete Output Table
%I	Discrete Input Table	%R	Register Table
		%T	Discrete Temporary

* %L may only be used on Series 90-70

Do not write data to the system registers (%S, %SA, %SB, and %SC). Doing so may interfere with the normal operation of the programmable controller.

Series 90 TCP/IP Hardware Configuration Requirements

Target Series 90-70 programmable controllers requires the following:

- A TCP/IP Ethernet communications module (IC697CMM741H, PROM version 1.12 or later).
- Supporting LAN software (IC651ENS042, containing GSM version 2.09 or later, TCP executive 1.28 or later, and TCP/IP configuration editor 1.02 or later)
- CPU firmware must be release 4.12 or later

Target Series 90-30 programmable controllers require the following:

- A TCP/IP Ethernet communications module (IC697CMM321).
- CPU firmware must be release 5.0 or later

If you are using Logicmaster:

- Logicmaster version 4.0 or later must be used with Series 90-70 programmable controllers.
- Logicmaster version 6.0 or later must be used with Series 90-30 programmable controllers.

Caution

Do not use the Series 90 TCP/IP Communications enabler with a Series 90-70 programmable controller using C-blocks in the ladder *unless* the Series 90-70 CPU has been upgraded to version 6.0 firmware. The programmable controller may crash otherwise.

Series 90 TCP/IP Related Documents

You should have one or more of the following documents available when configuring your communications network:

Series 90-70 Programmable Controller Installation Manual (GFK-0262)

If you are using an Ethernet Module, you should also have the following manual available:

TCP/IP Ethernet Communications for the Series 90-70 Programmable Controller (GFK-1004)

Series 90 TCP/IP Installation Verification Procedures

The Series 90 Diagnostic Program (**`hctdiag.exe`**) is a program provided with the Series 90 TCP/IP Communications enabler that you can use to check the basic operation and configuration of your network without starting CIMPLICITY HMI software.

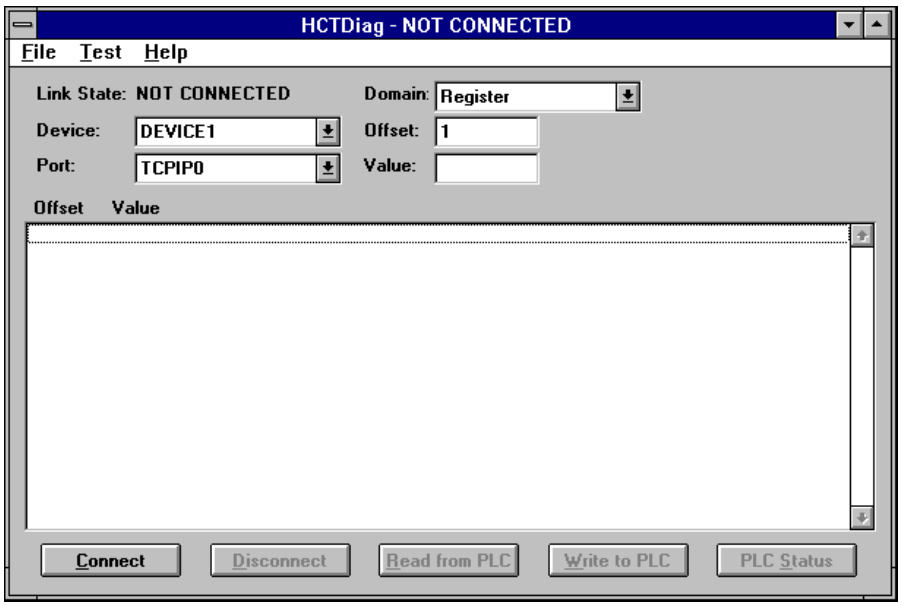
You can perform the following functions:

- Live update of the currently displayed domain
- Read load test
- Write load test

For this program to function, CIMPLICITY HMI software's Series 90 TCP/IP Communications enabler must be successfully installed, and you must have configured the TCP/IP port and Series 90 devices using CIMPLICITY HMI application configuration functions.

To start the diagnostic program, click the *Series 90 Diagnostics* icon in the CIMPLICITY HMI Configuration cabinet.

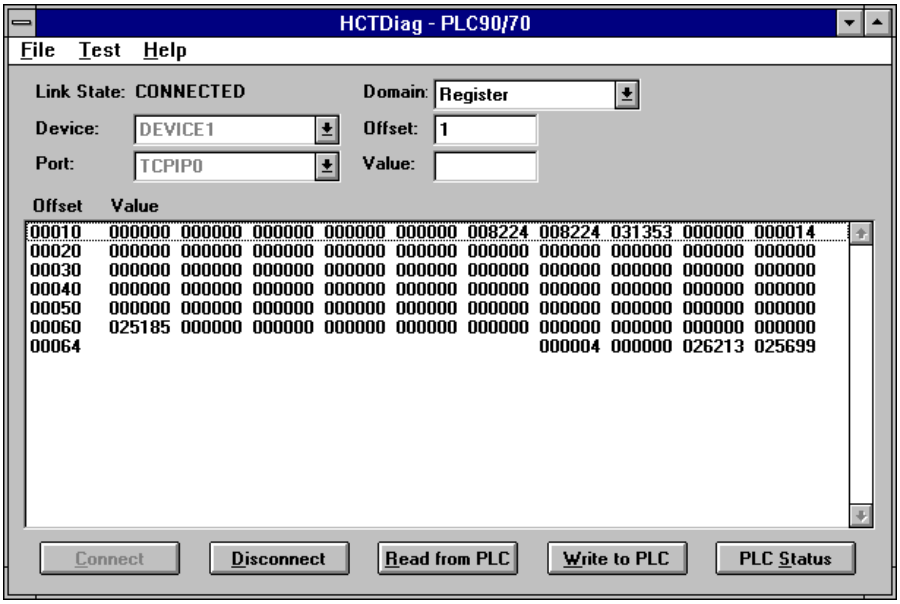
The *HCTDiag* window opens.



To connect to a Series 90 programmable controller in the TCP/IP network:

1. Click on the drop-down list button to the right of the **Device** input field to display the list of currently configured devices, and select a Series 90 device from the list.
2. Click on the drop-down list button to the right of the **Port** input field to display the list of currently configured ports, and select the TCP/IP port to use.
3. Click on the drop-down list button to the right of the **Domain** input field to display the list of currently supported domains (memory types), and select a domain to display.
4. Select **Connect**.

The program makes the connection with the programmable controller, and displays the values contained in the requested domain.



To display the data for another domain, just select the domain from the drop-down list in the **Domain** input field. The data for the new domain is automatically read and displayed in the data box.

You can use the menus and pushbuttons to do the following:

- Toggle between manual and automatic data update modes.
- Request manual reads of domain data
- Request writes to the programmable controller
- Display programmable controller status
- Perform a read load test
- Perform a write load test

Toggling Between Data Update Modes

Normally, domain data is only read when the domain display is initiated or when you click on the **Read from PLC** or **Write to PLC** buttons. You can have data updated automatically by doing the following:

1. Click on the **File** menu.
2. Select **Live Update** from the submenu.

When **Live Update** is enabled, the domain values are read and updated automatically approximately every three (3) seconds.

To return to manual mode:

1. Click on the **File** menu. Note that **Live** Update has a check mark next to it.
2. Select **Live Update** again to turn off the Live Update mode.

Requesting Manual Reads of Domain Data

If you are not in Live Update mode, you can manually request reads of the domain by selecting **Read from PLC**.

Writing Test Data to the Programmable Controller

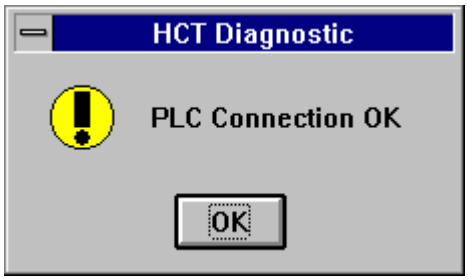
You can use this window to write test data to the Series 90 programmable controller.

1. Select the domain to write to. Note that if you select a domain that is read-only, **Write to PLC** is disabled (grayed out).
2. Enter the memory location offset that you want to write to in the **Offset** input field.
3. Enter the value you want to write in the **Value** input field.
4. Select **Write to PLC**.

The value is written to the offset location, and the data display box updates to reflect your write request.

Checking Series 90 Status

Select **PLC Status** to display the current status of the programmable controller. An *HCT Diagnostic* dialog box opens.



Select **OK** to close the dialog box.

Performing A Read Load Test

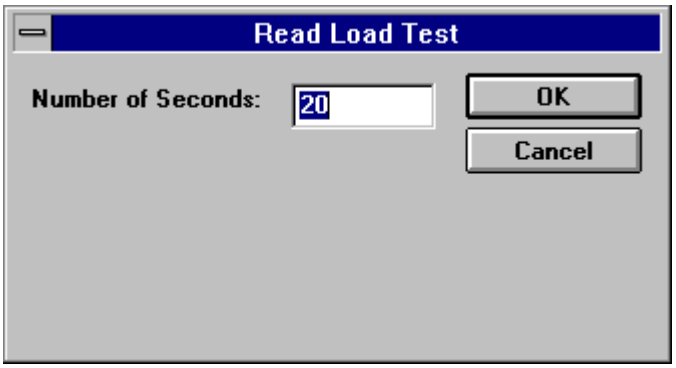
You can use **hctdiag.exe** to perform read load tests on your network. The read load test is performed in two parts:

- The first part tests the number of words per second that can be read over the network.
- The second part tests the number of read requests per second that can be made over the network.

The test reads data from all domains on the currently selected Series 90 device.

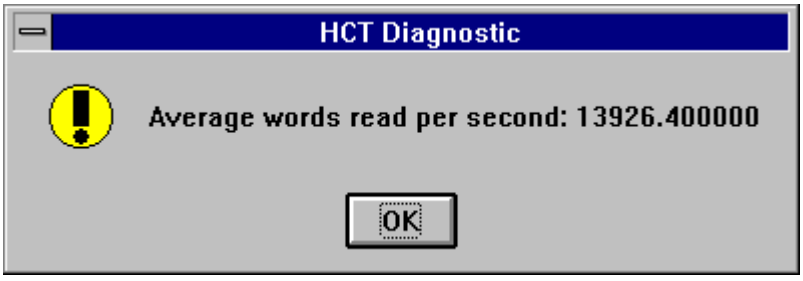
To perform a read load test:

1. Click on the **Test** menu.
2. Select **Read Load Test...** from the submenu. The *Read Load Test* dialog box opens.



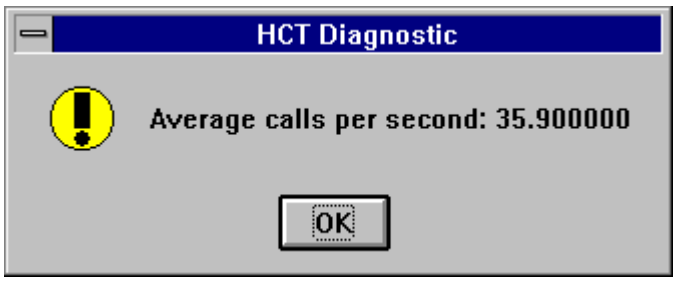
3. Enter the number of seconds you want to run the test in the **Number of Seconds** input field, and select **OK** to start the test.

   The test cycles through reads of all memory types on the current device for the number of seconds you specify. At the end of the time period, an *HCT Diagnostic* dialog box opens, telling you the average number of words read per second over the test period.



4. Select **OK** to proceed to the second part of the read test.

The test again cycles through reads of all memory types on the current device for the number of seconds you specified on the *Read Load Test* dialog box. At the end of the time period, an *HCT Diagnostic* dialog box opens, telling you the average number of read requests made per second over the test period.



5. Select **OK** to terminate the test.

Performing A Write Load Test

Warning

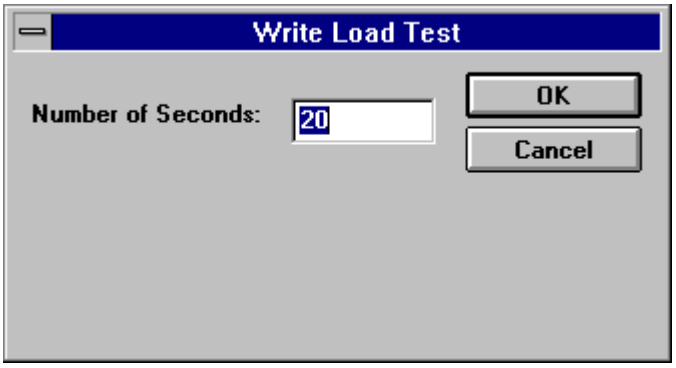
This test will overwrite the contents of the register domain (%R). Do not run this test if the register domain of the programmable controller contains important information.

You can use **hctdiag.exe** to perform write load tests on your network. The write load test tests the number of words per second that can be written over the network.

The test writes data to the register domain (%R) on the currently selected programmable controller.

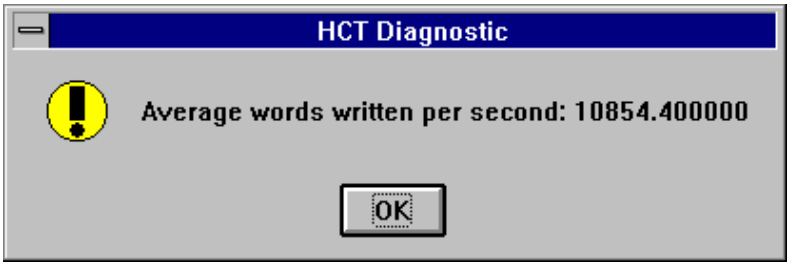
To perform a write load test:

1. Click on the **Test** menu.
2. Select **Write Load Test...** from the submenu. The *Write Load Test* dialog box opens.



3. Enter the number of seconds you want to run the test in the **Number of Seconds** input field, and select **OK** to start the test.

   The test cycles through writes of register memory on the current device for the number of seconds you specify. At the end of the time period, an *HCT Diagnostic* dialog box opens, telling you the average number of words written per second over the test period.



4. Select **OK** to terminate the test.

Series 90 PLC Fault Table

In CIMPLICITY projects with Series90 Ethernet protocol enabled, you can obtain PLC fault information from the Series90 Fault Table. You can invoke the fault table from the Workbench by double clicking on its icon, in either the left or right pane.

To find the Series90 Fault Table in the Workbench:

1. Click the *Equipment* folder in the left pane of the Workbench.
2. Click the *Diagnostics* folder.

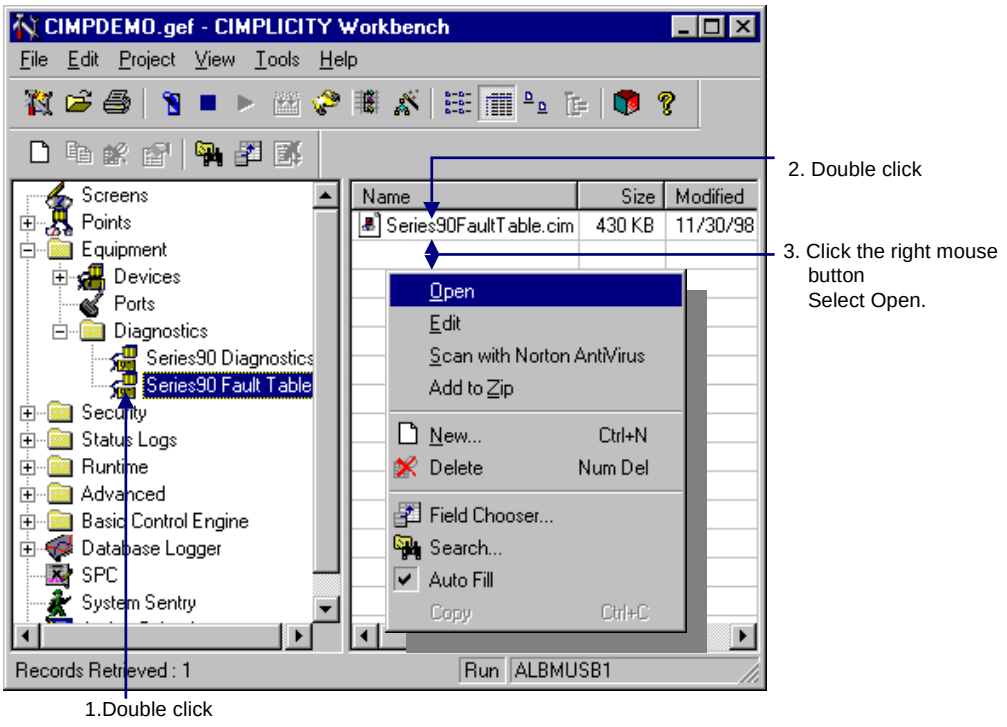
Method to Open the Series 90 Fault Table

Choose any of the following methods to open the Series 90 Fault Table:

1. Double click the *Series 90 Fault Table* icon in the left pane or
2. Select the *Series 90 Fault Table* icon in the left pane and double click **Series 90FaultTable.cim** in the right pane.
3. Click the right mouse button over Series 90FaultTable.cim in the Workbench right pane.

   Select **Open** from the popup menu.

Methods for Opening the Series90FaultTable



The Series 90FaultTable is empty when it opens.

When the Fault Table is opened the user can select a configured Series 90 device by using the device browser.

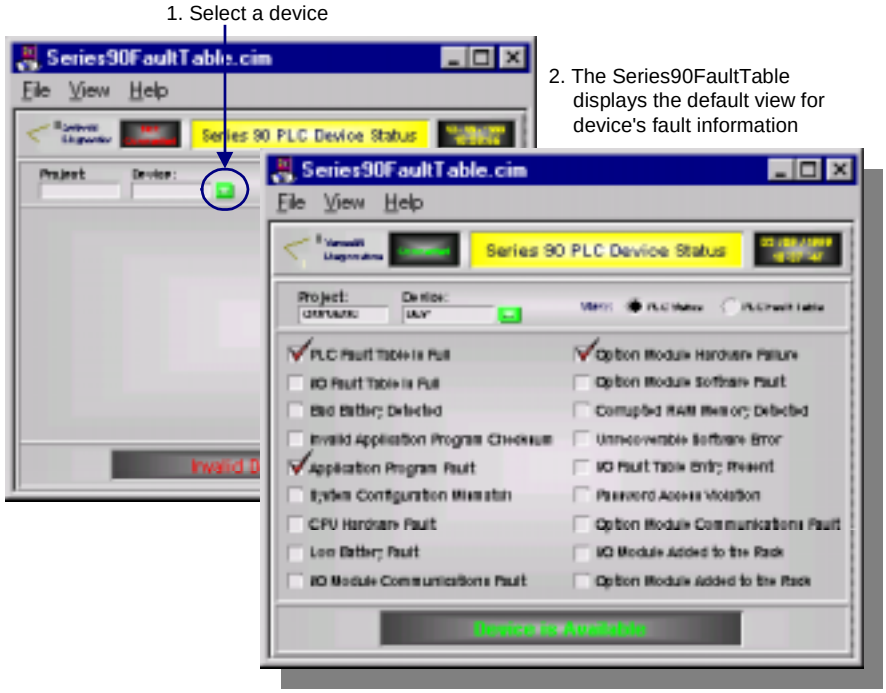
Method to Obtain Series 90 PLC Fault Information

To obtain PLC fault information:

1. Click the *Device* browser button.
2. Select a device from the *Select a Device* browser.

If the device is valid (the device is up and running) and the connection is made successfully the default view will appear for that device.

Series90FaultTable Displaying Information for a Selected Device



Series 90 Fault Table Default View

The default view is the PLC Status, which displays the PLC System Status References (%S, %SA, and %SB registers). The System Status References used and their definitions are as follows.

System Status Reference	Address
PLC Fault Table is Full	%S0009
I/O Fault Table is Full	%S0010
Bad Battery Detected	%S0014
Invalid Application Program Checksum	%SA0001
Application Program Fault	%SA0003
System Configuration Mismatch	%SA0009
CPU Hardware Fault	%SA0010
Low Battery Fault	%SA0011
I/O Module Communication Fault	%SA0014
Option Module Hardware Failure	%SA0027
Option Module Software Fault	%SA0031
Corrupted RAM Memory Detected	%SB0010
Unrecoverable Software Error	%SB0013
I/O Fault Entry Present	%SC0013

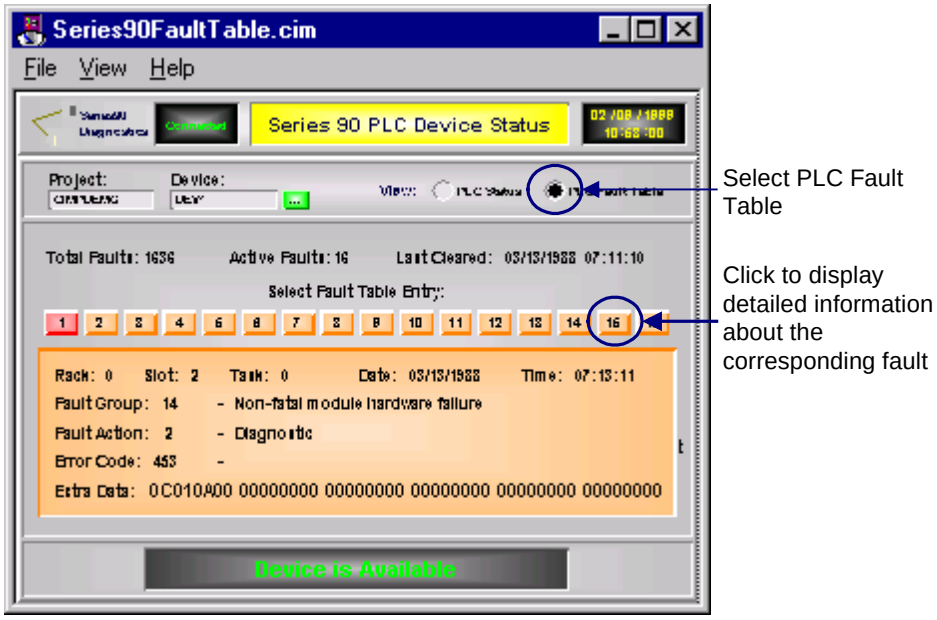
Password Access Violation	%SB0011
Option Module Communications Fault	%SA0015
I/O Module Added to Rack	%SA0019
Option Module Added to Rack	%SA0020

The user can select the PLC Fault Table view to display the actual fault information. The number of faults can vary from zero to sixteen. For each fault in the PLC fault table a button will appear on the screen.

Series 90 Fault Table Detailed View

Press the button that corresponds to the fault to view detailed information about the fault. The Series 90 - 70 and 90 – 30/20 Reference Manuals can be used to interpret the extra data.

Series90FaultTable PLC Fault Table View


Series90FaultTable.cim
File View Help
Series 90 PLC Device Status
Project:
Device:
Total Faults: 1636
Active Faults: 16
Last Cleared: 03/13/1988 07:11:10
Select Fault Table Entry:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 16
Rack: 0 Slot: 2 Task: 0 Date: 03/13/1988 Time: 07:13:11
Fault Group: 14 - Non-fatal module hardware failure
Fault Action: 2 - Diagnostic
Error Code: 453 -
Extra Data: 0C010A00 00000000 00000000 00000000 00000000 00000000
Device is Available
Select PLC Fault Table
Click to display detailed information about the corresponding fault

Series 90 TCP/IP Application Configuration

When you are configuring ports, devices, and device points, you will be asked for the some information that is specific to Series 90 TCP/IP communications.

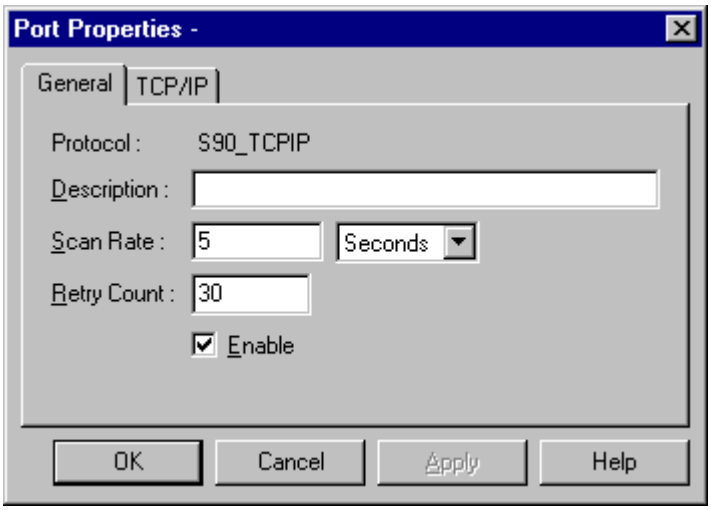
Series 90 TCP/IP Port Configuration

When you configure a new port for Series 90 TCP/IP communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **S90_TCPIP** from the list of protocols.
2. In the **Port** field, select the communication port that will be used for Series 90 TCP/IP communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

General Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description Enter an optional description to help you identify the port.

Scan Rate Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

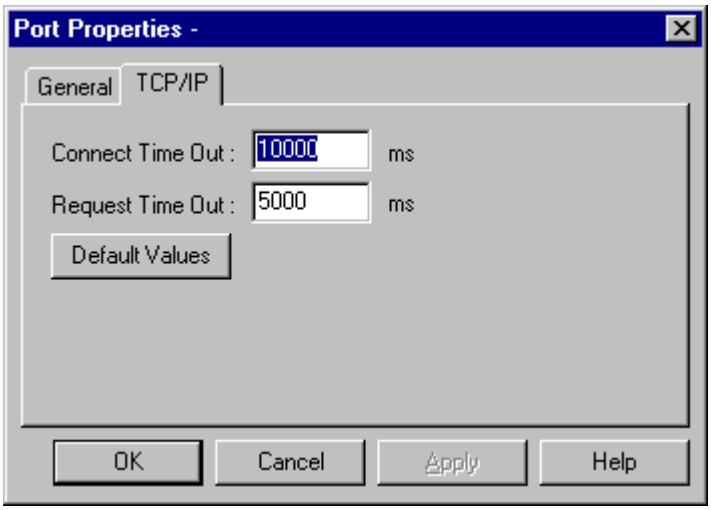
You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count If communications cannot be established to a device on this port, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connection to it.

Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

TCP/IP Properties



Use the *TCP/IP* properties to enter information about TCP/IP communications for the port. You can define the following:

Connect Time Out Enter the number of milliseconds to wait when making a connect request to a device.

Request Time Out Enter the number of milliseconds to wait when waiting for a request to complete.

Important

There is one global timeout for the **Connect Time Out** and one for the **Request Time Out** values for ***all*** Series 90 TCP/IP ports on your computer. If you change the timeout duration in the dialog box, the timeout duration is changed throughout. This can affect CIMPLICITY Control 90.

You can enter your own values or select **Default Values** to use the factory default values. The default values are:

Connect Time Out 10000 ms (10 second)

Request Time Out 5000 ms (5 seconds)

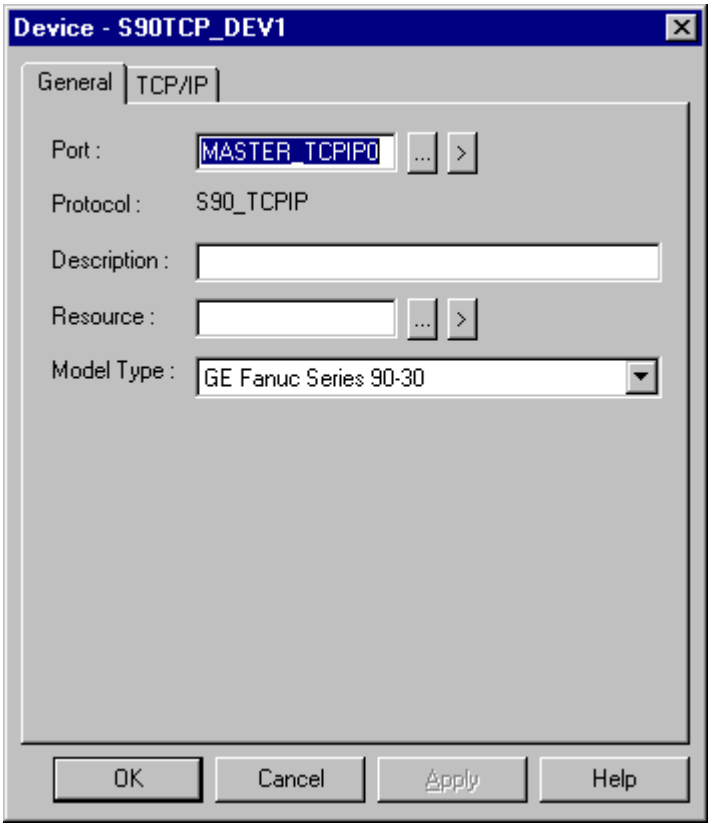
Series 90 TCP/IP Device Configuration

When you create a new device for Series 90 TCP/IP Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Series 90 TCP/IP port to be used by the device.

When you select **OK** to create the port, the *Device Properties* dialog box opens.

General Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - ... - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - > - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource

Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button - - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type

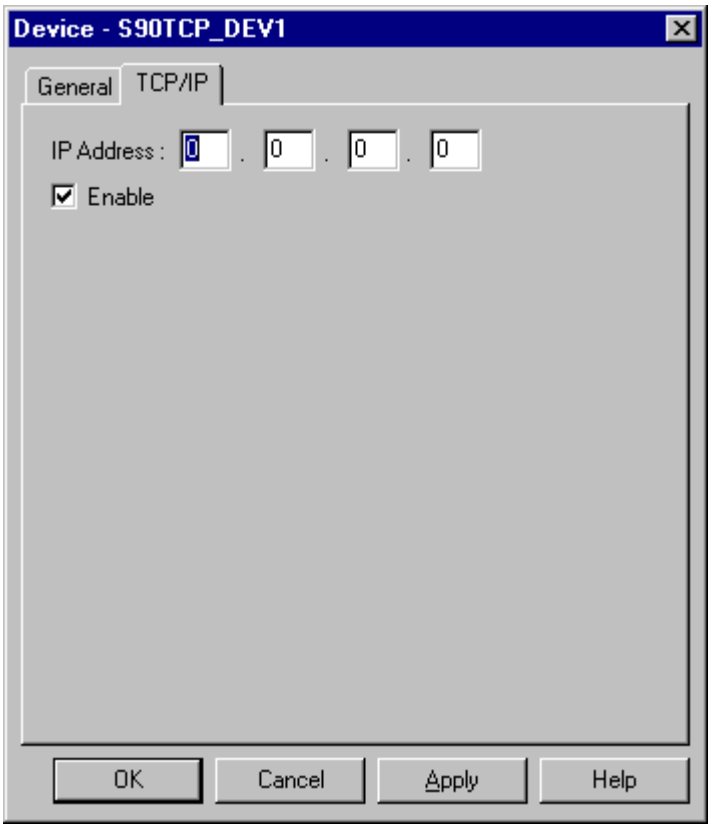
Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the choices are:

GE Fanuc Series 90-70

GE Fanuc Series 90-30

EGD Producer Device

TCP/IP Properties



Use the *TCP/IP* properties to enter information about TCP/IP communications for the device. You can define the following:

IP Address Enter the IP address of the Ethernet card on the Series 90 device in these four fields.

Enable Select this check box to enable the device when the project starts. If you clear this check box, the device will not be enabled and points associated with the device will be unavailable.

Series 90 TCP/IP Point Configuration

When you define a point, the following fields have values that are unique to or have special meanings for Series 90 TCP/IP communications:

General Page

On the *General* property page, you may configure points for **Read** or **Read/Write** access.

Device Page

On the *Device* property page:

Address

For all memory types except **%L**, enter the memory type and offset in the **Address** field. The address format is:

```
<memory type><address>
```

For example, to specify Register 1, the address is **%R1**. All offsets have a minimum value of 1.

The address of **%L** memory types requires the block name. Block names *must* be unique over all programs in the programmable controller. Block names cannot begin with a numeric character. The address format is:

```
%L<address><block name>
```

For example, to specify the fifth word in the **%L** domain in the program block ABC, the address is **%L5ABC**.

Update Criteria

The update criteria determine how the data will be requested.

Select **On Change** or **On Scan** for points whose value should be polled by Series 90 TCP/IP communications at regular intervals.

Select **On Demand On Change** or **On Demand On Scan** for points whose values should be polled by Series 90 TCP/IP communications at regular intervals when users are viewing them.

Select **Unsolicited** for points that are updated by unsolicited messages from devices

Point Type

Select one of the following:

- For device points, select **Normal**.
- For diagnostic points, select **Diagnostic**. The Series 90 TCP/IP Communications enabler uses standard diagnostic points.

The **Ethernet Global Data** selection is reserved for GE Fanuc use.

When you are configuring Boolean points in memory types that are not bit addressable, you must also enter data in the following field:

Address Offset

Enter the bit offset that corresponds to the bit position within the word.

Series 90 TCP/IP Unsolicited Data Support

The Series 90 TCP/IP Communications enabler supports the receipt of unsolicited data from Series 90-70 and Series 90-30 PLCs. The maximum message size is 2048 bytes.

All unsolicited points for the Series 90 TCP/IP Communications enabler need to be configured on the first TCP/IP port (TCPIP0). Unsolicited points on other ports will not be received.

A CIMPLICITY HMI device point can be updated by unsolicited data messages if it meets the following criteria:

- The point length in bytes is less than or equal to the data length that is transmitted in the message.
- The Series 90 TCP/IP address of the device configured for the point matches that of the sending device.
- The configured point address matches the Memory Type and Starting Address in the unsolicited data message.

If the data length of the message exceeds the point length, the point is *not* updated and a message is logged to the *Status Log*.

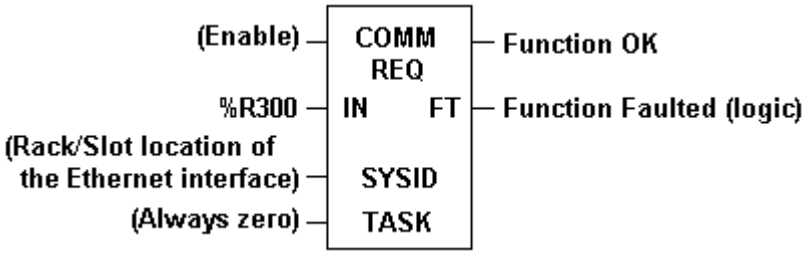
Unsolicited Messages

For detailed information about the Unsolicited Message format, see the ***TCP/IP Ethernet Communications for the Series 90-70 Programmable Controller*** (GFK-1004).

The following is an example of a COMREQ Function Block and a COMREQ Command Block that will:

- Establish a channel (channel 7 in this example) to a remote Host application server at IP address 3.0.0.1.
- Return the Communication Request Status (CRS) word to %R10.
- Send local PLC registers %R50-%R57 to the remote Host.
- Repeat the send ten (10) times once every 7 seconds with a time-out of 500 ms. for each read.

The COMREQ function block for this example is:



The COMREQ Command Block for this example is:

Address	DEC	Hex	Description
%R300	0017	0011	Length of Send Information Report Data Block
%R301	0000	0000	Always zero
%R302	0008	0008	Memory type or CRS word (%R)
%R303	0009	0009	CRS word address minus 1 (%R10)
%R304	0000	0000	Reserved
%R305	0000	0000	Reserved
%R306	2010	07DA	Send Information Report Channel Command number
%R307	0007	0007	Channel number (7)
%R308	0010	000A	Number of repetitions (10)
%R309	0003	0003	Time unit for send period (3 = seconds)
%R310	0007	0007	Minimum interval between host accesses (7 seconds)
%R311	0050	0032	Time-out on each individual host transfer response (500 ms)
%R312	0008	0008	Memory type from which to send data (%R)
%R313	0050	0032	Starting address from which to send data (%R50)
%R314	0008	0008	Number of memory units (8 registers)
%R315	0000	0000	Reserved
%R316	0000	0000	Reserved
%R317	0001	0001	Remote network address type (IP address)
%R318	0004	0004	Remote network address length in words (4)
%R319	0003	0003	Remote Host - Register 1 of IP address (3)
%R320	0000	0000	Remote Host - Register 2 of IP address (0)
%R321	0000	0000	Remote Host - Register 3 of IP address (0)
%R322	0001	0001	Remote Host - Register 4 of IP address (1)

Unsolicited Compound Messages with Timestamps

The Series 90 TCP/IP Communications enabler supports a compound message format for unsolicited data that allows the PLC to send multiple registers in a single unsolicited message.

The enabler uses defined *Transmission Areas* to determine if a message is a simple or compound unsolicited message. You can configure up to eight of these areas by adding entries to the global parameters file that define the transmission area number (1-8) and starting address in the PLC.

The following is an entry to use **%R500** as a transmission area:

```
UNSO_TX_AREA_1|1|R500
```

When using Compound Messages:

- You will need to define a point for each sub-packet with the correct domain, offset and length.

GE Fanuc recommends that you *not* configure points that conflict with addresses in the unsolicited transmission areas.

Transmission Area Format in a PLC:

The format for a compound message in a transmission area is

Description	Size (in bytes)
Format	2
Reserved	2
Number of Sub-Packets	2
Sub-Packet 1 Domain	2
Sub-Packet 1 Domain Offset	2
Sub-Packet 1 Length	2
Sub-Packet 1 Timestamp	8
Sub-Packet 1 - first data word	
.	
.	
Sub-Packet 1 - last data word	
.	
.	
Sub-Packet n Domain	2
Sub-Packet n Domain Offset	2
Sub-Packet n Length	2
Sub-Packet n Timestamp	8
Sub-Packet n - first data word	
.	
.	

Sub-Packet n - last data word

where:

- **Format** must be 1.
- **Reserved** must be 0.
- **Number of Sub-Packets** is the number of Simple Messages contained in the Compound Message.

Each sub-packet is essentially a Simple Message that has a common header and a variable length data area. The sub-packet header is as follows:

- **Sub-Packet Domain** - the PLC data type from which the data in the Sub-Packet originates. The contents of this field will be a number representing the data type as follows:

Value	PLC Data Type
0	Local Data Block (%L) 90/70 Only
8	Register table (%R)
10	Analog Input table (%AI)
12	Analog Output table (%AQ)
16	Discrete Input table (%I)
18	Discrete Output table (%Q)
20	Discrete Temporary (%T)
22	Discrete Internal (%M)
56	Genius Seamless (%G)
24	Special Contacts A (%SA)
26	Special Contacts B (%SB)
28	Special Contacts C (%SC)
30	System Fault , (%S) read only

- **Sub-Packet Domain Offset** - the domain start address of the data in the Sub-Packet. This field is numeric and quoted in units of the domain data type starting at zero.
- **Sub-Packet Length** - the length of data in the Sub-Packet. This field is numeric and quoted in bytes.

  If the Sub-Packet domain is **%L**, then the first 8 bytes of data contain the block name for the **%L** domain.
- **Timestamp** - the time relating to the data in the Sub-Packet, in CIMPLICITY COR_STAMP format.

Sample Compound Message:

A compound message block at %R512 to send the value 99 to %R600 with a timestamp of March 4, 1995 05:06:07.08 would be:

Address	Value	Description
%R512	1	Format
%R513	0	Reserved
%R514	1	Number of subpackets
%R515	8	Subpacket 1 domain
%R516	600	Subpacket 1 domain offset
%R517	2	Subpacket 1 length in bytes
%R518	27360	Low order date timestamp
%R519	304	High order date timestamp
%R520	14436	Low order time timestamp
%R521	77	High order time timestamp
%R522	99	Data value

Calculating the Timestamp:

The definition of the COR_STAMP structure is:

```
typedef struct cor_time_stamp {
   COR_I4   yyyymmdd;
   COR_I4   hhmmsstt;
} COR_STAMP;
```

where **COR_I4** is a four-byte integer.

For example, for the date March 4, 1995 and time 05:06:07.08, the COR_STAMP structure looks like this:

19950304

05060708

To save the date or time timestamp in Registers, you will need to do the following:

- Divide the 8-byte date or time by 65536 and put the quotient in the high order timestamp register.
- Multiply the quotient by 65536, subtract the result from the original number and put the result in the low order timestamp register.

For example, to place the timestamp of March 4, 1995 05:06:07.08 in Register memory starting at %R518:

%R519 = 19950304 / 65536 = 304

%R518 = 19950304 - (304*65536) = 19950304 - 19922944 = 27360

%R521 = 05060708 / 65536 = 77

%R520 = 05060708 - (77*65536) = 05060708 - 05046272 = 14436

Series 90 Ethernet Global Data

Ethernet Global Data (EGD) lets a Series 90 PLC repeatedly send a portion of its memory onto the network to multiple targets. This predefined set of information is called an Exchange. With Ethernet Global Data, you can collect data efficiently at a fixed rate from disparate domains on one or more Series 90 PLCs.

A device that uses Ethernet Global Data can be a producer (sender of data) or a consumer (receiver of data). For Series 90 TCP/IP Communications, Series 90 PLCs are producers of data and the CIMPLICITY HMI computer is a consumer of data.

Significant features of EGD include:

- A single request for data from a CIMPLICITY HMI Server causes data packets to be sent repetitively from the PLC.
- The set of data variables to be sent periodically can be pre-defined in the PLC so that the PLC starts sending the data as soon as it is initialized.
- Data can be sent to the specific CIMPLICITY HMI Server that requested it, or it can be sent simultaneously to a group of CIMPLICITY HMI Servers.

Ethernet Global Data is identified by the name or IP address of the producer and an Exchange number. CIMPLICITY uses the device name and the Exchange number from the point address to request the Exchange.

Ethernet Global Data Configuration

The format of the **Address** field is **Exchange:Offset**, where:

Exchange is the Exchange number configured on the PLC.

Offset is the 1 based offset in byes from the beginning of the Exchange.

For **Point Type** select **Ethernet Global Data**.

You also need to configure a scan rate or a trigger for the point.

Addressing Example:

Exchange 9 accesses 20 bytes of data starting at the first byte in the Exchange. Therefore, the **Address** field contains **9:1**.

Ethernet Global Data Configuration File

The file used to configure Ethernet Global Data is called **EGD.INI** and resides in the Windows directory. This file is modified by CIMPLICITY software. You should not edit this file by hand. This information is provided so that you can interpret the information in the file.

The format of the file is:

```
#[EXCHANGE_DEFS]
#Page  Length  Period  Producer  Consumer  Flags
9      20      1000    DEV1      ALNT37    E=9
```

where:

Page is the Exchange number.

Length is the number of bytes of data in the Exchange. This is calculated from the Exchange offset for the point and the point size.

Period is the time in milliseconds (ms) at which the Exchange must be polled. This is based on the poll rate for the fastest point in the Exchange.

Producer is the name of the Series 90 device that supplies the Exchange data.

Consumer is the name of this computer.

Flags contains the flags for the Exchange. Currently supported values are:

E=<exchange number>

IMPORTANT

If the provider is using multicast addresses then the multicast address needs to be pre-pended to the address "224.0.7.1:2:1". This means that an EGD provider is multicasting to address 224.0.7.1 on exchange 2 and the data begins at offset 1.

About Series 90 TCP/IP Redundancy

The Series 90 TCP/IP Redundancy enabler supports cabling redundancy and PLC redundancy for Series 90 TCP/IP communications.

- PLC redundancy lets you configure redundant pairs of Series 90 PLCs.
- Cabling redundancy lets you configure two network paths to the same PLC.

This enabler also supports configurations that combine PLC redundancy with cabling redundancy.

Currently there are two GE Fanuc products and several Trimation products covered by a sales representation agreement with GE Fanuc that can be used for applications requiring CPU or I/O redundancy. The GE Fanuc configurable products are the Series 90-70 hot-standby, synchronized CPU and the GMR system. The Trimation products are the HBR-30, HBR-70, and TMR-30.

About PLC Redundancy

For PLC redundancy, the Series 90 TCP/IP Redundancy enabler operates in "Hot Standby" mode, such that CIMPLICITY software automatically communicates with the slave PLC in the redundant pair when the master PLC fails. CIMPLICITY software connects to both PLCs, but only reads data from and writes data to the active master. To the user, the two physical devices are viewed as a single logical device. Points are configured for the logical device thus eliminating the need for duplicate configuration.

You configure the logical device by entering two TCP/IP addresses, one for the configured primary PLC and one for the configured secondary PLC. When the enabler starts, the primary PLC is the master and the secondary PLC is the slave. Under normal operating conditions, the enabler reads data from and writes data to only the master PLC, and checking the "health" of the slave PLC.

The enabler requires the redundant PLC pair to communicate with each other and to indicate (via a mode flag) which programmable controller is acting as the current master. The PLC sets the "mode flag", at a configured address, whenever a failover takes place. CIMPLICITY software monitors the mode flag, at a configured interval, to determine which PLC is acting as the master.

Important

Since the Mode Address is specified at the port level, *all* redundant PLCs associated with a port *must* use the same Mode Address. This means that all PLCs on the port must have the same model type (that is all 90-70s or all 90-30s)

Failure Conditions and Actions

When the enabler detects the following conditions, the following actions are taken:

Communication failure to the current slave Series 90

The enabler generates an alarm and continues to communicate with the current master Series 90 PLC.

The enabler then retries communications to the slave Series 90 PLC at the configured retry rate.

Communication failure to the current master Series 90

The enabler generates an alarm then performs a failover to the slave Series 90 PLC after ensuring the "mode" of the slave is changed to master. The slave Series 90 PLC is now the new master.

The enabler then retries communications to the new slave Series 90 PLC at the configured retry rate.

Failover or failback is detected

The enabler generates an alarm and begins communicating to the current, active master Series 90.

The enabler retries communications to the failed PLC at the configured retry rate.

Mode bits indicate no current master

The enabler generates an alarm and no further communication takes place to either PLC in the redundant pair.

The enabler continues to monitor the mode bits at the configured heartbeat timer interval.

You can override this default behavior with the GMR_NO_MASTER global parameter.

Mode bits indicate multiple masters

The enabler generates an alarm, marks the configured secondary Series 90 as "down", and communicates only with the configured primary Series 90.

The enabler continues to monitor the mode bits at the configured heartbeat timer interval.

About Cabling Redundancy

The Series 90 TCP/IP Redundancy Communications enabler can be configured to failover to a secondary cable when communicating to a pair of redundant PLCs. You can implement cabling redundancy with:

- One Ethernet LAN and two connections from each PLC to the Ethernet network.
- A redundant Ethernet LAN and one connection from each PLC to each cable in the Ethernet LAN.

When you use multiple Ethernet cards in the host computer, the Host IP Address and PLC IP Address in combination with the Subnet Mask of the Ethernet card determines which card/cable combination will be used.

About Combined PLC and Cabling Redundancy

If you implement both PLC and cabling redundancy, the enabler attempts to communicate over both cables to the current master PLC of the redundant pair. Once the enabler fails over to the secondary cable, it generates an alarm and updates the corresponding diagnostic point value. The enabler checks the failed primary cable periodically and automatically fails back to it when the cable is restored.

The enabler uses the following algorithm to determine which PLC and cable combination to use:

- The enabler tries to communicate to the current master over its primary cable.
- If that fails, the enabler tries to communicate to the current master over its secondary cable.
- If that fails, the enabler tries to communicate to the current slave over its primary cable.
- If that fails, the enabler tries to communicate to the current slave over its secondary cable.

Series 90 TCP/IP Redundancy Application Configuration

When you are configuring ports, devices, and device points, most of the information required is identical to the information required for the Series 90 TCP/IP communication enabler (non-redundant).

The differences are:

- When creating a Project, select the *S90 Redundancy* protocol. Note that when you select this protocol, the corresponding Port has a protocol ID of **S90_TCPIP_RED**.
- You must configure a **Mode Address** field and a **Heartbeat Timer** field in the *Port Properties* dialog box.
- Two TCP/IP addresses are required in the *Device Properties* dialog box- one address for each physical device in the redundant programmable controller pair.

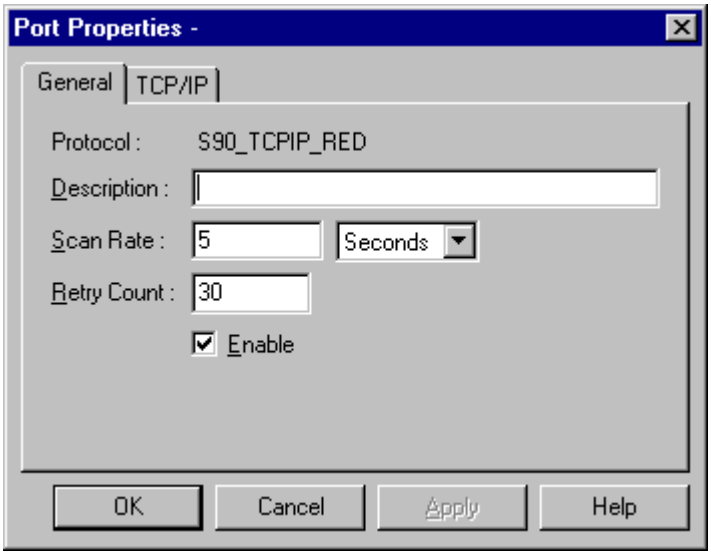
Series 90 TCP/IP Redundancy Port Configuration

When you create a new port for Series 90 TCP/IP Redundancy communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **S90_TCPIP_RED** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for Series 90 TCP/IP Redundancy communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

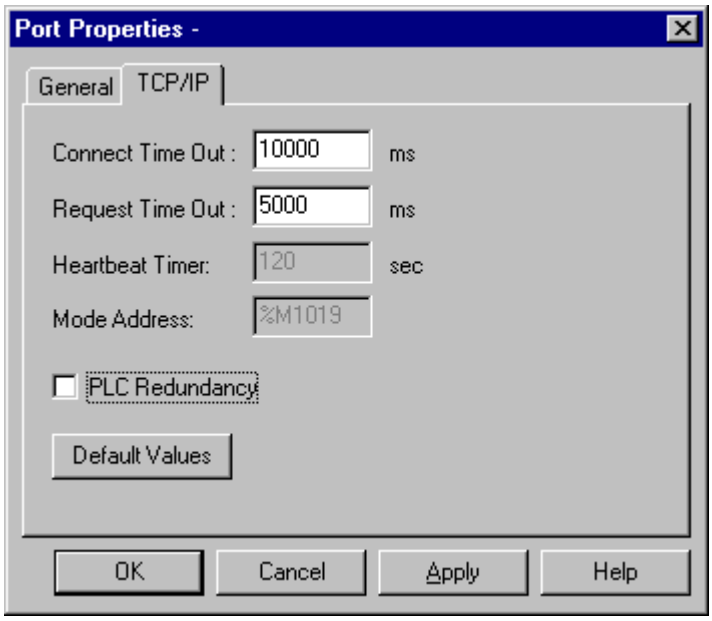
General Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify a scan rate in **Ticks** (100 ticks = 1second), **Seconds**, **Minutes**, or **Hours**.
Retry Count	If the enabler can not complete a setpoint (write/download) to a device due to any reason, retries are performed. Enter the number of retries to perform before reporting the action as “failed”.
Enable	Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

TCP/IP Properties



Use the *TCP/IP* properties to enter information about TCP/IP communications for the port. You can define the following:

Connect Time Out — Enter the number of milliseconds to wait when making a connect request to a device.

Request Time Out — Enter the number of milliseconds to wait when waiting for a request to complete.

Heartbeat Timer — This field is only available if you select the **PLC Redundancy** option.

Enter a value in seconds that will be the "Heartbeat" interval for probing the Series 90 controllers. Do not set an interval lower than the **Scan Rate** for the port.

Each Series 90 controller in a redundant group will be probed at the "Heartbeat" interval to determine the state of the device.

Mode Address — This field is only available if you select the **PLC Redundancy** option.

Enter the starting address of the location of two consecutive status bits in digital memory that indicate the current state of the programmable controller.

- The first bit indicates the overall health of the programmable controller (1=healthy).

  The Series 90 nickname for this bit is LOC_READY

- The second bit indicates whether the programmable controller is the current master in the redundant pair (1=master).

  The Series 90 nickname for this bit is LOC_ACT.

Both status bits should be set by logic in the Series 90 controller, and will be read at the "Heartbeat" interval.

This address must be a legal address in the Series 90 controller or the heartbeat will fail.

Use **%S35** for Series 90-70.

User **%M1019** for Series 90-30.

PLC Redundancy Set this check box to enable PLC Redundancy for this port. When you do, the **Mode Address** field becomes available.

You can enter your own values or select **Default Values** to use the factory default values. The default values are:

Connect Time Out	1000 ms (1 second)
Request Time Out	5000 ms (5 seconds)
Heartbeat Timer	120 seconds (2 minutes)
Mode Address	%M1019

If you configure redundant devices for the port, then clear the **PLC Redundancy** check box, the following warning message will be displayed to remind you to review the redundancy setups for all devices currently configured for this port.

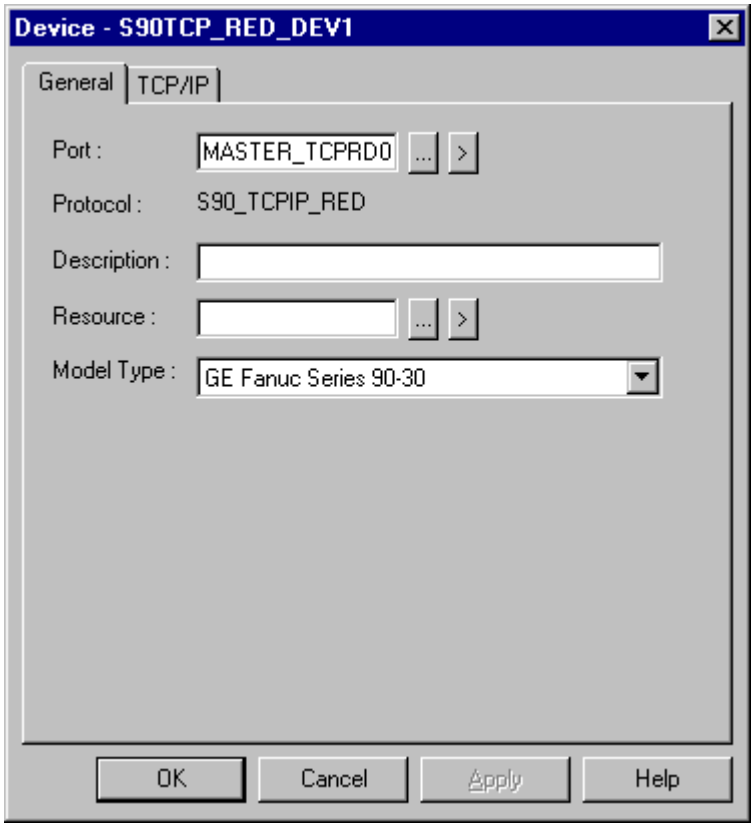
Series 90 TCP/IP Redundancy Device Configuration

When you create a new device for TCP/IP Redundancy communications, enter the following information in the New Device dialog box:

1. In the **Device** field, enter the name of the logical device you are configuring.
2. In the **Port** field, select the Series 90 TCP/IP Redundancy port to be used by this device.

When you select **OK** to create the device, the *Device Properties* dialog box opens.

General Properties



Use the *General* properties to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource Select the resource for this device.

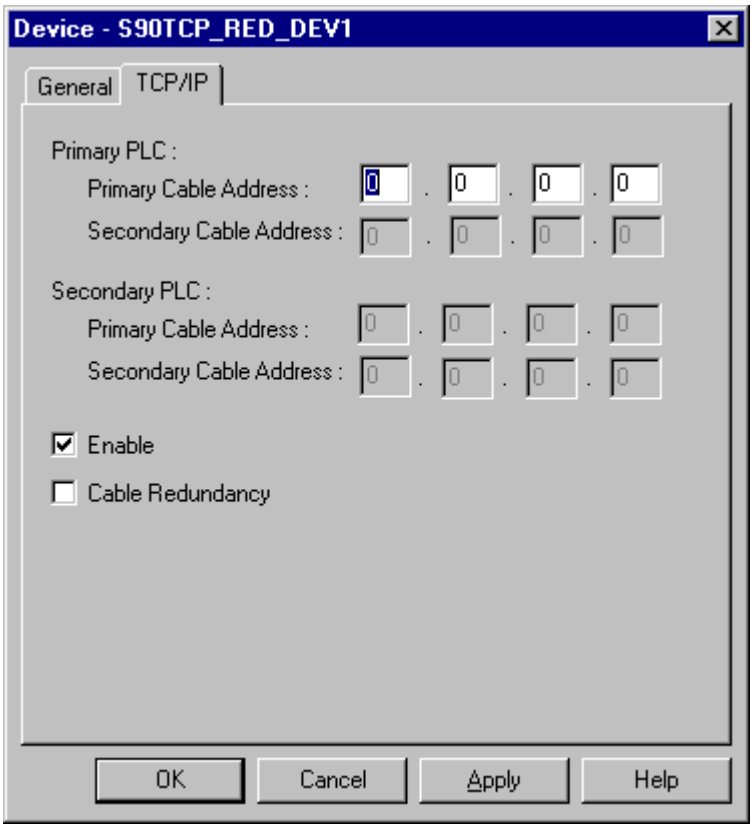
- You can click the Browser button - - to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button - - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the choices are:

GE Fanuc Series 90-70

GE Fanuc Series 90-30

TCP/IP Properties



Use the *TCP/IP* properties to enter information about TCP/IP communications for the device.

For the primary PLC of the redundant pair, you can define the following:

Primary Cable Address Enter the IP address of the primary Ethernet card in the primary PLC.

Secondary Cable Address This field is available only if you select the **Cable Redundancy** option.

Enter the IP address of the secondary Ethernet card in the primary PLC.

If you selected **PLC Redundancy** for the port, you can define the following for the secondary PLC of the redundant pair:

Primary Cable Address	Enter the IP address of the primary Ethernet card in the secondary PLC.
Secondary Cable Address	This field is available only if you select the **Cable Redundancy** option. Enter the IP address of the secondary Ethernet card in the secondary PLC.

For the device, you can select the following:

Enable	Select this check box to enable the device when the project starts. If you clear this check box, the device will not be enabled and points associated with the device will be unavailable.
Cable Redundancy	Select this check box if redundant cabling is being used for this device. If you clear this check box, the **Secondary Cable Address** fields in this dialog box are disabled.

Series 90 TCP/IP Redundancy Point Configuration

When you define a point, the following fields have values that are unique to or have special meanings for Series 90 TCP/IP Redundancy communications.

General Page

On the *General* property page, you may configure points for **Read** or **Read/Write** access.

Device Page

On the *Device* property page:

Address

For all memory types except **%L**, enter the memory type and offset in the **Address** field. The address format is:

```
<memory type><address>
```

For example, to specify Register 1, the address is **%R1**. All offsets have a minimum value of 1.

The address of **%L** memory types requires the block name. Block names *must* be unique over all programs in the programmable controller. Block names cannot begin with a numeric character. The address format is:

```
%L<address><block name>
```

For example, to specify the fifth word in the **%L** domain in the program block ABC, the address is **%L5ABC**.

In addition to the standard diagnostic points, you can configure a set of Series 90 TCP/IP Redundancy diagnostic points. The data structure type of all diagnostic points is **UINT**.

Update Criteria The update criteria determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by Series 90 TCP/IP communications at regular intervals.

Select **On Demand On Change** or **On Demand On Scan** for points whose values should be polled by Series 90 TCP/IP communications at regular intervals when users are viewing them.

Point Type Select one of the following:

- For device points, select **Normal**.
- For diagnostic points, select **Diagnostic**. The Series 90 TCP/IP Communications enabler uses standard diagnostic points.

When you are configuring Boolean points in memory types that are not bit addressable, you must also enter data in the following field:

Address Offset Enter the bit offset that corresponds to the bit position within the word.

Series 90 TCP/IP Redundancy Diagnostic Points

You can configure a set of diagnostic points for each CIMPLICITY device. Each diagnostic point is automatically updated by the enabler at run-time to indicate the status of the controllers. There are three diagnostic points that are unique for the TCP/IP Redundancy device communication enabler.

- The Mode point provides information about each device.
- The Status point provides an overall indication of the state of the device/cable.
- The Data Source point indicates which device/cable is supplying the current data.

Mode Diagnostic Points

You can create a mode point for each physical PLC. The point contains the following information:

Description	Bit	Value
Device health	1	1 = device OK
Current master	2	1 = current master
Connection status	3	1 = connected
CPU status	4	1 = CPU is running

The first and second bits contain the mode information from the programmable controller. The mode address is defined in the **Mode Address** field on the *TCP/IP* property sheet in the *Port Properties* dialog box when you create the port.

The third bit indicates whether a connection is established to the programmable controller.

The fourth bit indicates the status of the CPU. The CPU is considered "not in run mode" if its state is any of the following:

STOP_IO_DISABLED

CPU_STOP_FAULTED

CPU_HALTED

CPU_SUSPENDED

STOP_IO_ENABLED

The addresses for the Mode diagnostic points are:

$2,4	Mode Point - Primary PLC
$2,5	Mode Point - Secondary PLC

Status Diagnostic Point

You can create a Status point for each cable connection. If configured, the point will be set to one of the following values:

Value	Description
0	OK - Indicates the enabler can connect to the PLC over this cable and the PLC has the expected state.
1	NOT OK - Indicates there is a problem with either the cable connection or the state of the PLC.
2	This cable is not configured.

The addresses for the Status diagnostic points are:

$2,0	Status Point - Primary PLC over Primary Cable
$2,1	Status Point - Primary PLC over Secondary Cable
$2,2	Status Point - Secondary PLC over Primary Cable
$2,3	Status Point - Secondary PLC over Secondary Cable

Data Source Diagnostic Point

You can create a Data Source point for each logical CIMPLICITY device. If configured, the point will be set to one of the following values:

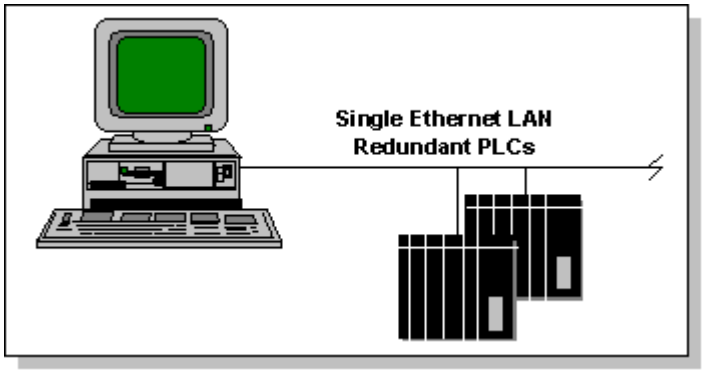
Value	Description
0	No communication on any cable
1	Current data is collected from the Primary PLC over the Primary Cable
2	Current data is collected from the Primary PLC over the Secondary cable.
3	Current data is collected from the Secondary PLC over the Primary Cable.
4	Current data is collected from the Secondary PLC over the Secondary Cable.

The addresses for the Status diagnostic point is:

$2,6 Data Source Point

Examples of Redundant Configurations

PLC Redundancy Example



In this configuration, each PLC of the redundant pair has one connection to a single Ethernet LAN.

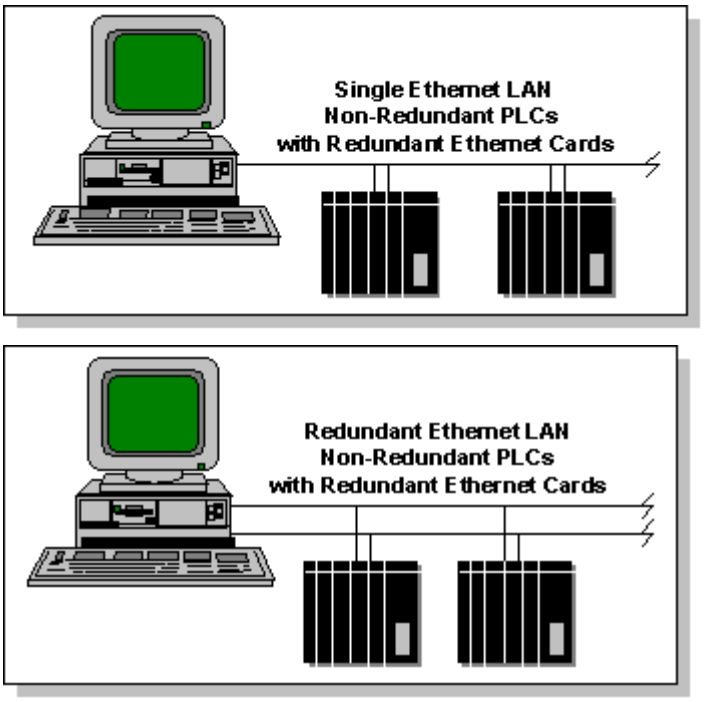
To configure the port, you need to enter the following special information on the port's *TCP/IP* properties page:

1. Set the **PLC Redundancy** check box. Remember that when you do this, all PLCs you configure on this port must support PLC redundancy.
2. Enter the **Mode Address**. This address must be used by all the redundant PLCs that you configure on this port.

To configure the redundant device, you need to enter the following special information on the device's *TCP/IP* properties page.

1. Clear the **Cable Redundancy** check box.
2. Enter the IP address of the **Primary PLC** in its **Primary Cable Address** field.
3. Enter the IP address of the **Secondary PLC** in its **Primary Cable Address** field.

Cabling Redundancy Example



In this configuration, each non-redundant PLC has a redundant connection to an Ethernet LAN. The LAN can be a single or redundant Ethernet LAN.

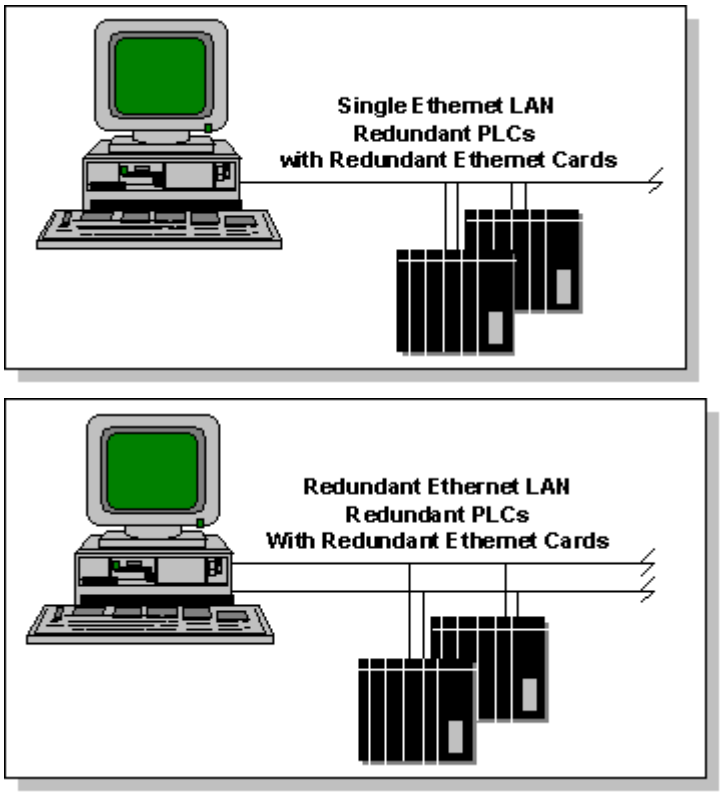
To configure the port, you need to enter the following special information on the port's *TCP/IP* properties page:

1. Clear the **PLC Redundancy** check box. Remember that when you do this, none of the PLCs on this port can use PLC redundancy.

To configure the redundant cabling, you need to enter the following special information on the device's *TCP/IP* properties page.

1. Set the **Cable Redundancy** check box.
2. Enter the IP address of the primary Ethernet card in the **Primary Cable Address** field for the **Primary PLC**.
3. Enter the IP address of the secondary Ethernet card in the **Secondary Cable Address** field for the **Primary PLC**.

Combined PLC and Cabling Redundancy Example



In this configuration, each PLC of the redundant pair has two connections to an Ethernet LAN.

To configure the port, you need to enter the following special information on the port's *TCP/IP* properties page:

1. Set the **PLC Redundancy** check box. Remember that when you do this, all PLCs you configure on this port must support PLC redundancy.
2. Enter the **Mode Address**. This address must be used by all the redundant PLCs that you configure on this port.

To configure the redundant device, you need to enter the following special information on the device's *TCP/IP* properties page.

1. Set the **Cable Redundancy** check box.
2. Enter the IP address of the primary Ethernet card on the primary PLC in its **Primary Cable Address** field for the **Primary PLC**.
3. Enter the IP address of the secondary Ethernet card on the primary PLC in the **Secondary Cable Address** field for the **Primary PLC**.
4. Enter the IP address of the primary Ethernet card on the secondary PLC in the **Primary Cable Address** field for the **Secondary PLC**.
5. Enter the IP address of the secondary Ethernet card on the secondary PLC in the **Secondary Cable Address** field for the **Secondary PLC**.

Series 90 TCP/IP Advanced Configuration Topics

You can control some of the Series 90 TCP/IP Communications and Series 90 TCP/IP Redundancy Communications options through global parameters. This section discusses those global parameters and their settings. *See the "Global Parameters" topic in the CIMPLICITY Base System User's Manual (GFK-1180) for details on setting global parameters.*

HCT_SKIP_L_DOMAIN

By default, during startup, the Series 90 TCP/IP Communications enabler verifies **%L** domains on all devices. You can significantly improve the startup time by disabling the verification of **$L** domains.

If you select this option, any CIMPLICITY points you configure in %L domains display the "unavailable" value at run-time.

To disable the verification of **%L** domains, add the following to the global parameter file:

```
HCT_SKIP_L_DOMAIN|1|YES
```

GMR_SKIP_L_DOMAIN

By default, during startup, the Series 90 TCP/IP Redundant Communications enabler verifies **%L** domains on all devices. You can significantly improve the startup time by disabling the verification of **$L** domains.

If you select this option, any CIMPLICITY points you configure in %L domains display the "unavailable" value at run-time.

To disable the verification of **%L** domains, add the following to the global parameter file:

```
GMR_SKIP_L_DOMAIN|1|YES
```

UNSO_TX_AREA_<n>

You can define up to eight (8) transmission areas for compound unsolicited messages.

To define a transmission area, add the following to the global parameter file:

```
UNSO_TX_AREA_<n>|1|<address>
```

where **<n>** is a number from 1 to 8 and **<address>** is the starting address of the transmission area in the PLC.

For example,

```
UNSO_TX_AREA_1|1|R500
```

defines a transmission area starting at **%R500**.

Note that the size of the transmission area depends on the number of packets and the size of each packet.

GMR_WRITE_ALL

By default, the Series 90 TCP/IP Redundant Communications enabler only reads data from and writes data to the active master. You can change the enabler, via a global parameter, to write data to both programmable controllers in the redundant pair.

Note

The read behavior cannot be changed.

To enable this option, add the following to the global parameter file:

```
GMR_WRITE_ALL|1|YES
```

GMR_NO_MASTER

By default, when the Series 90 TCP/IP Redundant Communications enabler loses its connection to the master PLC of a redundant pair and the slave PLC fails to set its Master bit, the enabler declares a $DEVICE_DOWN alarm for the redundant device and marks all its points as "Unavailable" until one of the PLCs declares itself the master.

You can use a global parameter to change this behavior so that when the master PLC of a redundant pair fails, the enabler automatically starts collecting data from the slave PLC, without waiting for it to set its Master bit.

To enable this option, add the following to the global parameter file:

```
GMR_NO_MASTER|1|YES
```

Seriplex Communications

About Seriplex Communications

Seriplex Communications supports communications over the Square D Seriplex Control bus to Discrete I/O Modules. The driver is available for use on Intel based PCs running Windows NT with the SPX-PC-INTF PC Interface card.

Seriplex Communications lets you configure card initialization parameters such as Clock Speed, Frame Size and Interface Mode, as well as supporting Multiplexed I/O.

You may have up to six Seriplex cards (called SERIPL0, SERIPL1, etc.) on your computer.

This enabler supports the following CIMPLICITY HMI features:

- Polled read at user-defined rates
- Poll after setpoint
- Triggered reads
- Analog deadband

This enabler supports the following CIMPLICITY HMI data types:

- Signed 8, 16, and 32 bit integer
- Unsigned 8, 16, and 32 bit integer
- Digital
- Arrays

Supported Seriplex Devices

Seriplex Communications currently supports communication to non-multiplex and multiplex I/O devices through the Square-D PC Interface card (SPX-PC-INTF).

Communication to the following I/O Modules has been validated:

- Material Pull Pendant Station (SQDSPXBWPEND5)

Other Seriplex I/O modules, including multiplex and non-multiplex I/O modules have not been tested, but should work identically since the device communications module does not deal directly with the Seriplex Bus.

Supported Seriplex Memory Types

Data may be read from or written to the following memory types using Seriplex communications:

Memory Type	Description	Access
NMIA[1] or **NMID**[2]	Non-Multiplex Input Buffer	Read Only
NMOA[1] or **NMOD**[2]	Non-Multiplex Output Buffer	Read/Write
NMPA[1] or **NMPD**[2]	Non-Multiplex Passthru Buffer	Read/Write
SSB	Safe State Buffer	Read/Write
MI	Multiplex Input Buffer	Read Only
MO	Multiplex Output Buffer	Read/Write
MP	Multiplex Passthru Buffer	Read/Write
SW	Status Word	Read Only
ESW	Extended Status Word	Read Only
PRODUCT_ID	Product ID Code	Read Only
FW_VERSION	Firmware Revision ID	Read Only
IF_OPMODE	Interface Mode	Read/Write
HWD_ENABLE	Host Watchdog Enable	Read/Write
HWD_EVENT	Host Watchdog Event	Read/Write
HWD_FAULT_ACK	Host Watchdog Fault Acknowledge	Read/Write

[1] Analog based offset. See *Seriplex Device Point Configuration* for details.

[2] Digital based offset. See *Seriplex Device Point Configuration* for details.

Seriplex Hardware Configuration Requirements

You must install the interface module SPX-PC-INTF in the CIMPLICITY HMI computer. Seriplex Communications can support up to six (6) SPX-PC-INTF cards in one PC.

Seriplex Related Documents

You should have the following document available:

SERIPLEX PC Interface Card (SPX-PC-INTF) and PC/104 Interface Card (SPX-PC104-INTF) Instruction – Square D Instruction Bulletin (Bulletin No. 30298-005-01A)

Seriplex Card Installation Procedures

Do the following to install a Seriplex card in your computer:

1. Record the base address of the SPX-PC-INTF card.

   You can use SW2 on the card to set the base address. See the ***SPX-PC-INTF Installation*** section in the ***Seriplex PC Interface Card Instruction*** document for details about configuring the base address.

   A typical base address is 0xD0000. This is also the factory-set address of the card.

2. Set switch SW3 on the card to disable interrupts (this is default factory setting).
3. Install the card into any open slot in the backplane of the computer.
4. Create a file for Seriplex bus configuration settings. The format of this configuration file is explained in *Seriplex Bus Configuration File* later in this document.
5. Run the **Seriplex Configuration** program to register the card's configuration information.
6. Reboot the computer to enable the registry changes.

Use the **Seriplex Diagnostic Program** to verify the card configuration. Details about this program are explained later in this document.

Seriplex Bus Configuration File

Use the **`seriplex.cfg`** program to configure Seriplex Bus parameters. Seriplex Communications uses this file to configure bus parameters when the CIMPLICITY HMI project is started. Parameters that you can configure are:

- Clock Speed.
- Frame Size.
- Interface Mode.
- Interface Control.
- Multiplex Channel Size
- Multiplex Input Mapping Word.
- Multiplex Output Mapping Word.
- Priority Channel Enable.
- Priority Channel Number.
- Host Watchdog Time Constant.
- Fault Recovery Method.
- Fault Action.
- Safe State Buffer
- Non-multiplex passthru buffer
- Multiplex passthru buffer

A sample **seriplex.cfg** configuration file exists in the **%BSM_DATA%** sub-directory of your **CIMPLICITY\HMI** root directory. The sample file explains the format and rules for the bus configuration file.

```
; Seriplex bus configuration file

;Rules for the configuration file
; Any line starting with a semi-colon (";") is considered a comment line
; blank lines (carriage return) are ignored
; parameter name is enclosed in square brackets [parameter]
; parameter value MUST immediately follow on the next line
; parameter name is case sensitive and should be spelled exactly
; as shown in this sample configuration file
; It is not necessary to specify all parameters - if not specified
; default value is assumed

;Clock Speed - Acceptable values are form 0 -7 (default - 7)
;0 - 16.000 kHz , 1 - 20.000 kHz, 2 - 25.000 kHz, 3 - 32.000 kHz
;4- 50.000 kHz, 5 - 64.516 kHz, 6 - 75.472 kHz, 7 - 100 kHz
[Clock Speed]
7

; Frame Size - Acceptable values are form 0 -15 (default - 15)
; 0 - 16, 1 - 32, 2 - 48, .... 15 - 256
[Frame Size]
15

; Interface Mode - Acceptable values are form 0 - 1 (default - 1)
; 0 - mode 1 (peer-to-peer) ,  1 - mode 2 (master-slave)
[Interface Mode]
1

; Interface Control - Acceptable values are form 0 - 3 (default - 1)
; 0 - Monitor Mode , 1- Non-Multiplex only, 2-Multiplex Only, 3 - Mixed
[Interface Control]
1

; Multiplex Channel size - Acceptable values are form 0 - 3 (default - 3)
; 0 - 2, 1 - 4, 2 - 8, 3 - 16
[Multiplex Channel Size]
3

; Multiplex Input Mapping Word - is expressed in hexadecimal (default - 0x00)
[Multiplex Input Mapping Word]
0x1234

; Multiplex Output Mapping Word - is expressed in hexadecimal (default - 0x00)
[Multiplex Output Mapping Word]
0x5678

; Priority Channel Enable (default - 0)
; 0 - disable , 1 - enable
[Priority Channel Enable]
0

; Priority Channel Number - Acceptable values are form 0 - 15 (default - 15)
[Priority Channel Number]
0

;Host Watchdog Time Constant - Acceptable values are form 0 -3 (default -3)
; 0 - 131 ms, 1 - 262 ms, 2 - 524 ms, 3 - 1049 ms
[Host Watchdog Time Constant]
3

;Fault Recovery Method - (default - 0)
;0 - software recovery allowed, 1- requires interface reset command
[Fault Recovery Method]
0
```

```
;Fault Action - (default - 0)
; 0 - Force LONG_RESET
; 1- Transmit an Internal copy of safe state buffer
[Fault Action]
1

; Safe State Buffer - (32 bytes) (default - all bytes 0x00)
; The contents of safe state buffer at startup can be set up by
; configuring this parameter. The values are expressed in hexadecimal
; bytes. There should be 8 bytes per line. First byte on first line
; corresponds to 0 the offset of safe state buffer. It is not
; necessary to enter all 32 bytes.
; The following configuration sets the safe state buffer offsets 0 to 15
; to given value. We are not interested in setting offsets 16 to 31, hence
; there are only two lines of parameters.
[Safe State Buffer]
0x11,0x12,0x13,0x14,0x15,0x16,0x17,0x18
0x22,0x23,0x24,0x25,0x26,0x27,0x28,0x29


; Non-multiplex Passthru Buffer - (32 bytes) (default - all bytes 0x00)
; The contents of Non-multiplex Passthru Buffer at startup can be set up by
; configuring this parameter. The values are expressed in hexadecimal
; bytes. There should be 8 bytes per line. First byte on first line
; corresponds to 0 the offset of the buffer. If user is not interested
; in setting a certain offset the space can be left blank.  It is also not
; necessary to enter all 32 bytes.
; The following configuration sets the Non-multiplex Passthru Buffer offsets
;0 to 15
; to given value. We are not interested in setting offsets 16 to 31, hence
; there are only two lines of parameters.

[Non-multiplex Passthru Buffer]
0x11,0x12,0x13,0x14,0x15,0x16,0x17,0x18
0x22,0x23,0x24,0x25,0x26,0x27,28,29

; Multiplex Passthru Buffer - (240 words) (default - all words  0x0000)
; The contents of Multiplex Passthru Buffer at startup can be set up by
; configuring this parameter. The values are expressed in hexadecimal
; words. There should be 8 words per line. First word on first line
; corresponds to 0 the offset of the buffer. If user is not interested
; in setting a certain offset the space can be left blank.  It is also not
; necessary to enter all 240 words.
; The following configuration sets the Multiplex Passthru Buffer offsets
;0 to 9
; to given value. We are not interested in setting offsets 10 to 239, hence
; there are only two lines of parameters. Also note the blank parameters.

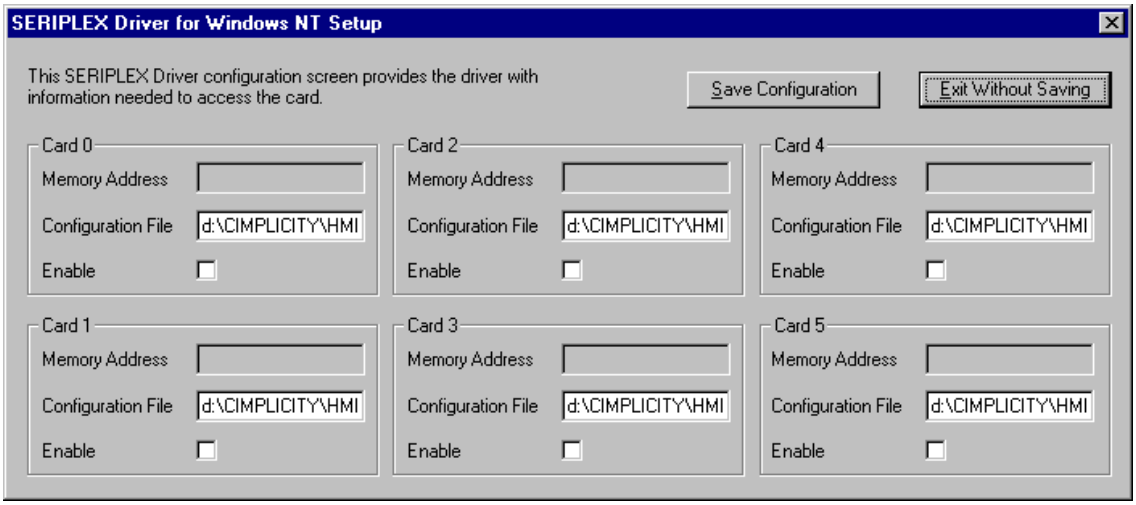

[Multiplex Passthru Buffer]
0x1112,0x1213,0x3456,1111,,,,
0x1314,0x1415,,,,,,
```

If you do not configure this file or the format of the file is incorrect, the default configuration will be used. The default values for the parameters are given in sample configuration file. In addition, a **`default configuration used`** message is logged in the status log.

Seriplex Configuration Program

This Seriplex driver configuration application provides the driver with information needed to access the card. To run the Seriplex Configuration program, select the *Seriplex Configuration* icon in the CIMPLICITY HMI program group.

The *Seriplex Configuration* dialog box opens.



This dialog box lets you configure the following information for each of up to six cards:

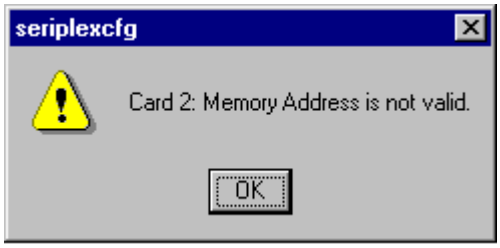
- Memory address to be used by the card.
- Configuration file name, including path.
- Enabled/disabled state of the card.

Configuring a Card

Set the **Enable** check box for the card. If the check box is cleared, the **Memory Address** field is disabled.

In the **Memory Address** field, enter the shared memory address in hexadecimal value. You recorded this value for the base address of the SPX-PC-INTF card.

If you enter an invalid address, a message window opens.



The card number in the message indicates which card has an invalid Memory Address. Click **OK** to go back to the configuration screen.

Enter the file name of the Seriplex Bus Configuration file in the **Configuration File** field. Be sure to include its complete path.

Saving Configuration Changes

After you enter your changes, select **Save Configuration** or press **Alt+S** to write the new configuration to the system registry.

If you just close the window, the changes you have made are *not* automatically saved. You *must* select **Save Configuration** or press **Alt+S** to save your changes and write the new configuration to the system registry.

Exit without Saving Configuration Changes

Select **Exit Without Saving** or press **Esc** or **Alt+E** when you have completed your configuration changes. The *Seriplex Configuration* dialog box closes and your changes are not written to the system registry.

Seriplex Diagnostic Program

The Seriplex Diagnostic program lets you test reading and writing data from and to the Seriplex card. To run this program:

1. Open your CIMPLICITY HMI project's *Configuration* cabinet.
2. From the **Tools** menu, select **Command Prompt...**.
3. In the *Command Prompt* window, type the following command:

```
spxdiag [<card num>] [r,w] [<address offset>] [<num of bytes>]
[<data>]
```

where

<card num> is the number of the configured card you are going to test.

r,w specifies read or write access. The default is read.

<address offset> specifies in hexadecimal the memory offset of the address you are going to access.

<num of bytes> is number of bytes to read or write.

<data> is the hexadecimal value required when a write is performed.

For example, you can issue the following command to read one byte of data at address 0x060 from card 1:

```
spxdiag 1 r 0x060 1
```

You should see the result similar to the following if command succeeds:

```
Data read success !
0x20
```

If the command is not successful, the program displays an appropriate error message.

In addition, you can issue the following command to write to address 0x060 of card 1 with a value of 0x30:

```
spxdiag 1 w 0x060 1 0x30
```

If the write is successful, the program will print out the following:

```
Data write success !
```

If the command is not successful, the program displays an appropriate error message.

Seriplex Application Configuration

When you configure ports, devices, and device points, you will need to enter some data that is specific to Seriplex communications. The following sections review the configuration requirements.

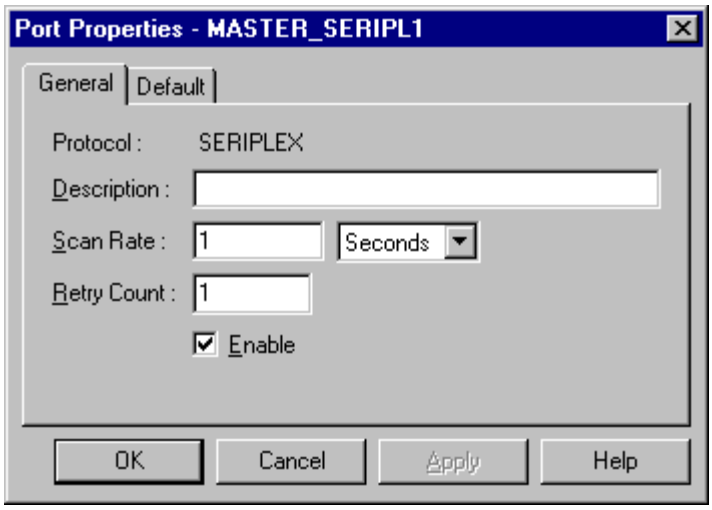
Seriplex Port Configuration

When you configure a port for Seriplex Communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **SERIPLEX** from the list of available protocols.
2. In the **Port** field, select the **SERIPL*n*** port that will be used for Seriplex communications. The port number must match the card number you configured in the *Seriplex Configuration* program.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

General Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description — Enter an optional description to help you identify the port.

Scan Rate — Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count — If communications cannot be established, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.

Enable Set this check box if you want the port to be enabled. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Default Port Properties

The *Default Properties* is not used for Seriplex Communications. Do not enter any information in **Baud Rate** and **Parity** fields.

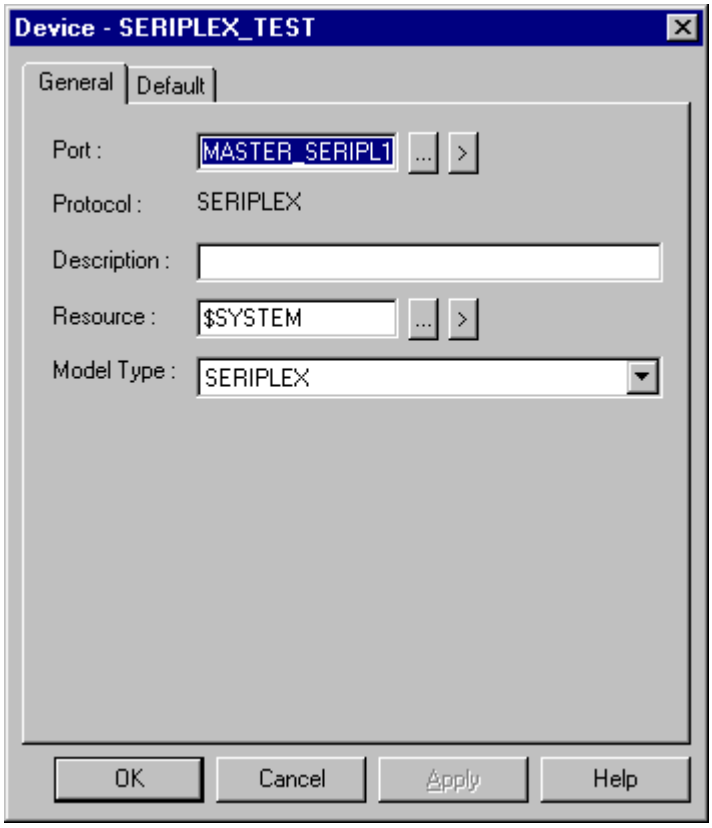
Seriplex Device Configuration

You can configure one and only one device per Seriplex port. When you create a device for Seriplex Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the SERIPL port to be used by the device.

When you click **OK** to create the device, the *Device Properties* dialog box opens.

General Device Properties



Use the *General* properties to enter general information for the port. You can define the following:

Port Select the port for this device.

- You can click the Browser button - ... - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - > - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource Enter the resource that can be associated with this device for alarm generation.

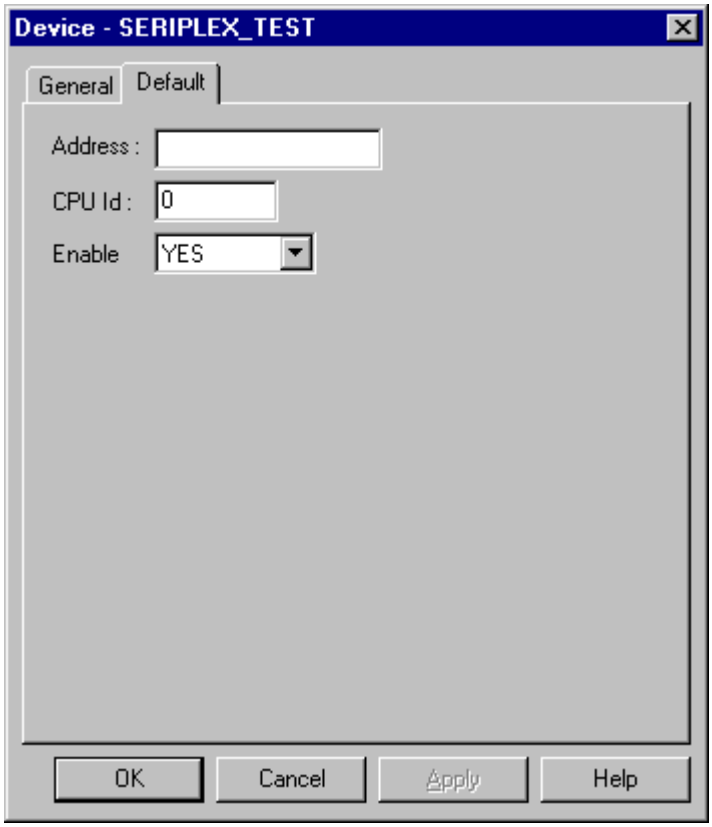
- You can click the Browser button - ... - to the right of the field to display the list of resources and select one.

You can click the Pop-up Menu button - > - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Enter the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol the only choice is:

SERIPLEX

Default Properties



Use the *Default* properties to enter the following information about the device:

Address *Not used.*

CPU ID *Not used.*

Enable Enter **YES** to enable the device. If you enter **NO**, the device will not be enabled, and points associated with the device will be unavailable.

Seriplex Device Point Configuration

When you define a point, the following fields have values that are unique to or have special meanings for Seriplex Communications.

General Point Properties

On the *General* property page, you may configure points for **Read** or **Read/Write** access.

Device Point Properties

On the *Device* property tab:

Update Criteria The update criteria determine how the data will be requested.

Select **On Change** or **On Scan** for points whose value should be polled by Seriplex communications at regular intervals.

Select **On Demand On Change** or **On Demand On Scan** for points whose values should be polled by Seriplex communications at regular intervals while users are viewing them.

Address Enter the memory type and offset in the **Address** field on the *Device* page of the *Point Properties* dialog box. The supported memory types are:

- **NM*xx***
- **SSB**
- **M*x***
- **SW**
- **ESW**
- **PRODUCT_ID**
- **FW_VERSION**
- **IF_OPMODE**
- **HWD_ENABLE**
- **HWD_EVENT**
- **HWD_FAULT_ACK**

Each memory type has a set of supported addresses.

Address Offset Enter the bit offset that corresponds to the bit position within the byte.

An address offset of 0 addresses the least significant bit of a register. An address offset of 7 addresses the most significant bit.

Seriplex Memory Type Details

Non-Multiplex Memory

The points of these memory types can be addressed as either analog points or digital points. If you use digital points, you can specify a bit address in the **Address Offset** field. For example, the non-multiplex input 13 can be addressed either as NMIA1 with address offset 5, or as NMID13.

The non-multiplex memory types are:

Memory Type	Size (bytes)	Format
Non-Multiplex Input Buffer	32	**NMIA0** through **NMIA31**
		NMID0 through **NMID255**
Non-Multiplex Output Buffer	32	**NMOA0** through **NMOA31**
		NMOD0 through **NMOD255**
Non-Multiplex Passthru Buffer	32	**NMPA0** through **NMPA31**
		NMPD0 through **NMPD255**

Safe State Buffer

The safe status buffer addresses are:

Memory Type	Size (bytes)	Format
Safe State Buffer	32	**SSB0** through **SSB31**

Multiplex Memory

Multiplex Input buffer and Multiplex Output buffer are used to store information from Multiplex Input and Output modules. The layout of these buffers groups all 16 possible multiplex channels associated with a base address together. Possible base addresses are from 16, 32, 48, …, 240. This gives you 15 possible multiplex modules with module numbers 1, 2, 3, …, 15. Each module can have 16 channels and each channel contains 16 bits of data.

CIMPLICITY HMI software lets you access the channel data as a word. You can also access individual bit data in the channels. There are two ways to address the multiplex channels. For example:

- MI16:2 accesses channel 2 of the multiplex input module whose base address is 16.
- MI1:2 also accesses the same channel.

To access the third bit of this channel, configure a digital point with address MI16:2 and enter 3 in the address offset field.

Note that base address 0 or module number 0 are invalid as they are reserved by SERIPLEX for internal usage.

The multiplex memory types are:

Memory Type	Size (bytes)	Format
Multiplex Input Buffer	480	**MI<module>:<channel>** **MI<module base addr>:<channel>**
Multiplex Output Buffer	480	**MO<module>:<channel>** **MO<module base addr>:<channel>**
Multiplex Passthru Buffer	480	**MP<module>:<channel>** **MP<module base addr>:<channel>**

Status Words

The status words are:

Memory Type	Size (bytes)	Format
Status Word	2	**SW0** through **SW1**
Extended Status Word	2	**ESW0** through **ESW1**
Product ID code	1	**PRODUCT_ID**
Firmware Revision ID	2	**FW_VERSION**

Refer to SPX-PC-INTF Card Instruction Bulletin to see the bit-wise details of these data type.

Interface Mode

the Interface Operating Mode can be set to one of the following:

0 NORMAL

1 SAFE STATE

2 FORCE_LONG_RE SET

The interface mode address is:

Memory Type	Size (bytes)	Format
Interface Mode	1	**IF_OPMODE**

Host Watchdog Enabler

Set this data to 1 to start the host watchdog timer. In addition, you need to configure the Watchdog parameters before starting the project.

Memory Type	Size (bytes)	Format
Host Watchdog Enable	1	**HWD_ENABLE**

Host Watchdog Event

The CIMPLICITY HMI project must periodically set this data if watchdog functioning has been enabled. Failure to do so will cause host watchdog timer fault.

Memory Type	Size (bytes)	Format
Host Watchdog Event	1	**HWD_EVENT**

Host Watchdog Fault Acknowledge

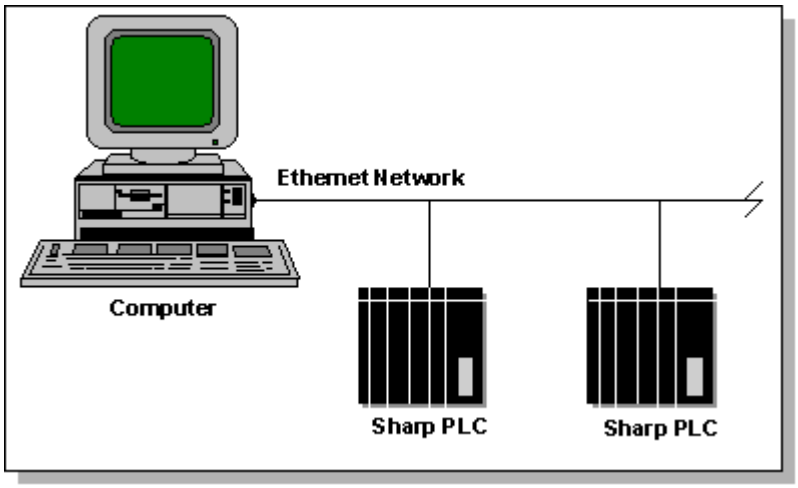
This data can be used to acknowledge the watchdog fault.

Memory Type	Size (bytes)	Format
Host Watchdog Fault Acknowledge	1	**HWD_FAULT_ACK**

Sharp TCP/IP Communications

About Sharp TCP/IP Communications

The Sharp TCP/IP communications module lets you exchange data between a CIMPLICITY HMI project and Sharp PLCs over an Ethernet network using TCP/IP protocol.



This enabler supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Unsolicited data
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Text
- Arrays

Sharp TCP/IP Communications Supported Devices

The following models of the Sharp New Satellite JW Series Programmable Controllers are supported by this communications interface:

JW-50CU
JW-70CU
JW-100CU

Sharp TCP/IP Communications Supported Memory Types

The following data memory types are supported by this communications interface:

File 0 register (includes I/O relay, Retentive relay, General purpose relay, TMR, CNT time limit contact, TMR, CNT, MD, and Register memory)

File-1 register

File-2 register

File-3 register

File-4 register

File-5 register

File-6 register

File-7 register

Write Enable Status

Sharp TCP/IP Communications Hardware Configuration Requirements

To use Sharp TCP/IP communications, you must have the following installed and configured in your computer:

- An Ethernet card
- TCP/IP communications

You must also have an Ethernet Interface Module type JW-50CM installed in the programmable controller.

Sharp TCP/IP Communications Related Documents

You should have the following documentation available when configuring this interface:

New Satellite JW series Programmable Controller - A User's Manual - Ethernet Interface Module type JW-50CM Rev 1.0.

Sharp Programmable Controller New Satellite JW Programming Manual

Sharp Programmable Controller New Satellite JW Instruction Manual

Sharp PLC Communications Configuration Checklist

Prior to using this communication interface, you *must* perform the following steps:

1. Install an Ethernet card in your computer.
2. Configure the minimum TCP/IP Communications for your computer, including assignment of a name and TCP/IP address for the computer.
3. Assign a TCP/IP address for each Sharp programmable controller.

   If you are on a company-wide or standardized network, obtain your TCP/IP addresses from your network administrator. Please refer to the PLC documentation for assistance in developing the needed ladder logic.
4. For each programmable controller communicating with CIMPLICITY software via Ethernet, assign a socket port number for the connection.

   If you are on a company-wide or standardized network, obtain your Ethernet port number from your network or system administrator. If you need to receive unsolicited data messages, use port number 6000H, 6001H, 6002H or 6003H, depending on the channel configuration. Please refer to the PLC documentation for assistance in developing the needed ladder logic.
5. The CIMPLICITY HMI project always initiates the TCP/IP connection. Configure all TCP/IP channels in the Sharp PLC used by CIMPLICITY HMI software as **TCP Passive**.
6. Configure the Windows NT TCP/IP address for each programmable controller on your computer.

   Use **`C:\WINNT\System32\drivers\etc\hosts`** for the configuration.

   In the **`hosts`** file, add one line for each programmable controller using the following format:

   ```
   <IP address> <PLC Name> <Alias Name>
   ```

   Separate the fields with at least one space. For example, if the IP address configured for a programmable controller is 1.2.3.4 and its host name is "SHARP", its line in the hosts file is:

   ```
   1.2.3.4 SHARP sharp
   ```

Sharp TCP/IP Communications Test Program

You can use the Sharp Test Program (**sharp_diag.exe**), provided with the Sharp TCP/IP communications option, to check your network configuration without starting a CIMPLICITY HMI project. You need to run this program from a command prompt window for your project.

To open a command prompt window for your project:

1. Open the *Configuration Cabinet* for your CIMPLICITY HMI project.
2. Select **Command Prompt...** from the **Tools** menu.

Enter the command you want at the MS-DOS prompt in the *Command Prompt* window.

- If the command succeeds a series of information messages displays
- If the command fails, then an appropriate error message displays. In this case, check your Ethernet connections, ladder logic and your computer configuration to ensure that all are configured correctly. Any error or inconsistency will prevent successful communication.

You can find detailed information about the Sharp PLC communication commands in the ***"New Satellite JW series" Programmable Controller - A User's Manual - Ethernet Interface Module type JW-50CM Rev 1.0*** manual.

Verifying the PLC Connection

Type the following command at the MS-DOS prompt in your command window to verify the connection between your computer and a Sharp PLC:

```
sharp_diag <Host Name> <Socket Port Number>
```

If the test succeeds, output with the following format displays:

```
Host name: <Computer name>     PLC name: <PLC name>     Port
number: <Port number>
<Computer name> is bound to the socket.
<Computer name> is connected to <PLC name>.
Communication between <Computer name> and <PLC name> is
disconnected (normal exit).
```

Example - Connection Verification

For example, if the computer name is *ABC123*, the configured host name is SHARP and the configured port number is 24576, the output for a command:

```
sharp_diag ABC123 24576
```

looks like this:

```
Socket port: 24576
Host name: ABC123     PLC name: SHARP     Port number: 24576
ABC123 is bound to the socket.
ABC123 is connected to SHARP.
Communication between ABC123 and SHARP is disconnected (normal
exit).
```

Testing PLC Communications

Type the following command at the MS-DOS prompt to test the network configuration and the communication between your computer and the PLC:

```
sharp_diag <Host Name> <Socket Port Number> COM
<command> [COM <…> (up to 10 commands)]
```

If the test succeeds, output with the following format displays:

```
Host name: <Computer name>     PLC name: <PLC name>     Port
number: <Port number>
<Computer name> is bound to the socket.
<Computer name> is connected to <PLC name>.
Command #1: <…>
Command #1 has been sent to the PLC successfully.
Command #2:…
…
Successfully read data from the PLC. The length of the response
message = <…>
…
Response for command #1: <…>
Response for command #2: …
…
Communication between <Computer name> and <PLC name> is
disconnected (normal exit).
```

Example - Communication Verification

For example, if the computer name is *ABC123*, the configured host name is SHARP and the configured port number is 24576, with two commands:

```
sharp_diag ABC123 24576 COM a2 com 24 0 0 2 1 0
```

the output looks like this:

```
Host name: ABC123     PLC name: SHARP     Port number: 24576
ABC123 is bound to the socket.
ABC123 is connected to SHARP.
Command #1: a2
Command #1 has been sent to the PLC successfully.
Command #2: 24 0 0 2 1 0
Command #2 has been sent to the PLC successfully.
Successfully read data from the PLC. The length of the response
message = 98
Response for command #1: a2 0 97 3 28 5
Response for command #2: 24 0 0 0 2 1 0 1
Communication between ABC123 and SHARP is disconnected (normal
exit).
```

Sharp TCP/IP Communications Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to Sharp TCP/IP communications.

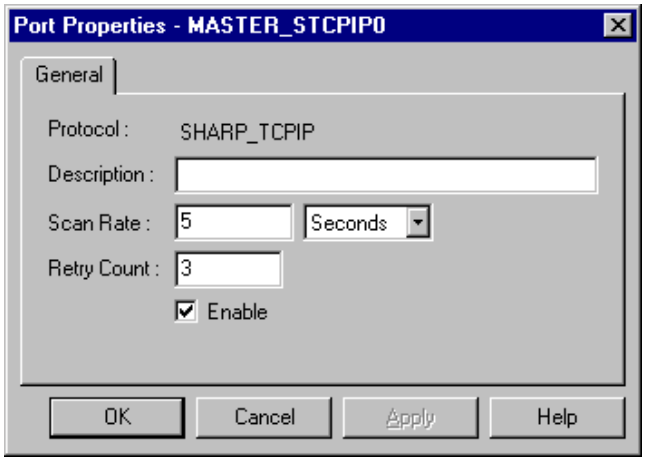
Sharp TCP/IP Port Configuration

When you create a new port for Sharp TCP/IP communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **SHARP_TCPIP** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for Modbus TCP/IP communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

Sharp TCP/IP General Port Properties



Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description — Enter an optional description to help you identify the port.

Scan Rate — Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count — If communications cannot be established to a device on this port, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connection to it.

Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

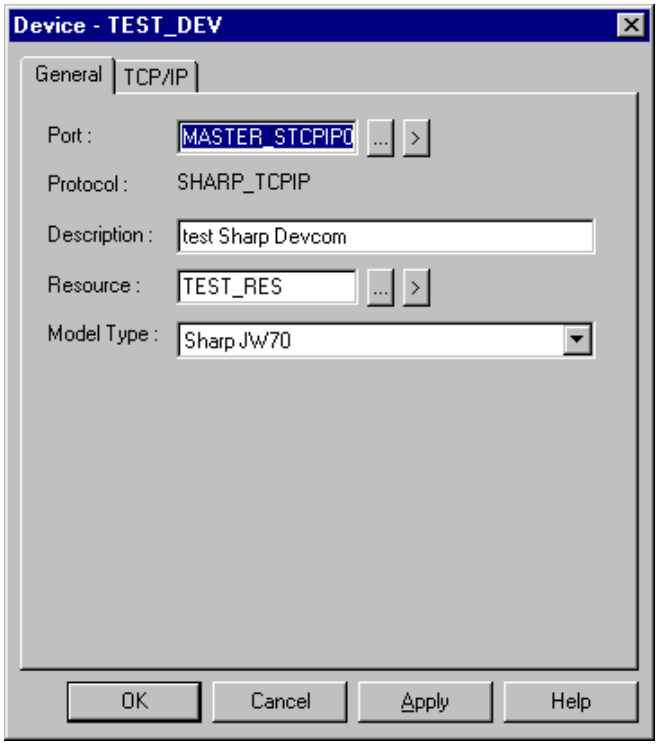
Sharp TCP/IP Device Configuration

When you create a new device for Sharp TCP/IP communications, enter the following information in the New Device dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Sharp TCP/IP port to be used by the device.

When you select **OK** to create the device, the *Device Properties* dialog box opens.

Sharp TCP/IP General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

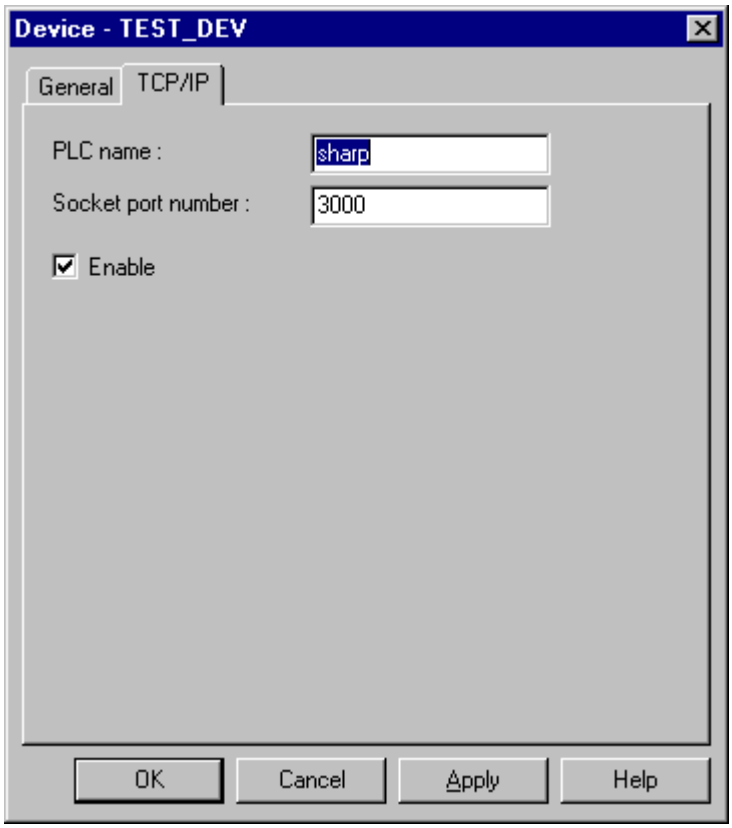
Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the choices are:

Sharp JW50
Sharp JW70
Sharp JW100

Sharp TCP/IP Device Properties



Use the TCP/IP tab in the Device dialog box to enter information about communications for the device. You can define the following:

PLC name

The PLC name must be configured *exactly* as it is configured under step 5 of Sharp PLC Communications Configuration Checklist.

Socket port number

The socket port number is a decimal number that must match the port number configured on the Sharp PLC.

For *unsolicited* data messages, the socket port number must be one of the following:

24576 (6000H)
24577 (6001H)
24578 (6002H)
24579 (6003H)

Base your selection on the channel configuration on your Sharp PLC.

Enable

Set this check box to enable the device when the project starts. If you clear this check box, the device will not be enabled and points associated with the device will be unavailable.

Sharp TCP/IP Point Configuration

Once your devices are configured, you may configure points for them. The fields described below have configuration values that are unique to or have special meaning to Sharp TCP/IP communications.

Sharp TCP/IP General Point Properties

On the General tab in the Point Properties dialog box, you may configure points for **Read** or **Read/Write** access.

Note

All writes are disabled by default. To enable data memory write on a device, you must first set its Write Enable Status.

For Write Enable Status points, set the following:

- **Access** must be **Read/Write**.
- **Point type** must be **Boolean**.
- **Element** must be set to **1**.

Sharp TCP/IP Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria

The update criteria determine how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by the Sharp TCP/IP driver at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by the Sharp TCP/IP driver while users are viewing them.

Select **Unsolicited** for points whose value will be sent by the programmable controller as necessary.

Address

Enter the point address of the data in the following format:

```
<File Register #>:<OFFSET>
```

The offset is entered in octal.

Please refer to the Sharp PLC documentation for the detailed information on these memory types.

Use the following address for a Write Enable Status point:

```
WRITE_MODE
```

Point Address Formats

Use the table below to determine how to specify your file register number and offset.

File Register Type	Data Memory Type	Offset (Octal)
0	I/O relay	0 - 77 (JW50)
		0 - 177 (JW70)
0	Retentive relay	700 - 777
0	General purpose relay	1000 - 1577
0	TMR, CNT time limit contact	1600 -1777
0	TMR, CNT, MD	2000 - 3777
0	Register	4000 - 17777
1	File-1 register	0 - 177777
2	File-2 register	0 - 177777
3	File-3 register	0 - 177777
4	File-4 register	0 - 177777
5	File-5 register	0 - 177777
6	File-6 register	0 - 177777
7	File-7 register	0 - 177777

Sharp TCP/IP Unsolicited Data

Unsolicited data is supported for the Sharp TCP/IP communication interface.

- You must develop ladder logic to send the unsolicited data from a Sharp PLC to the CIMPLICITY HMI host computer.
- Use the Sharp SEND/RECEIVE instruction to send data from the PLC to the CIMPLICITY HMI host computer.
- The ladder logic should also check to ensure that the connection has been made ***and*** that the requests are acknowledged.
- The destination file address used in the SEND/RECEIVE instruction must exactly match the unsolicited point address in the CIMPLICITY HMI project.
- For your CIMPLICITY HMI project to receive the data, you must configure the computer's IP address at the correct location in the "Station Number Correspondence Table" of the Ethernet module in the Sharp PLC.
- Any CIMPLICITY HMI point with the same starting address as the unsolicited data and whose size is less than or equal to the size of the unsolicited data updates when the PLC sends the unsolicited data.

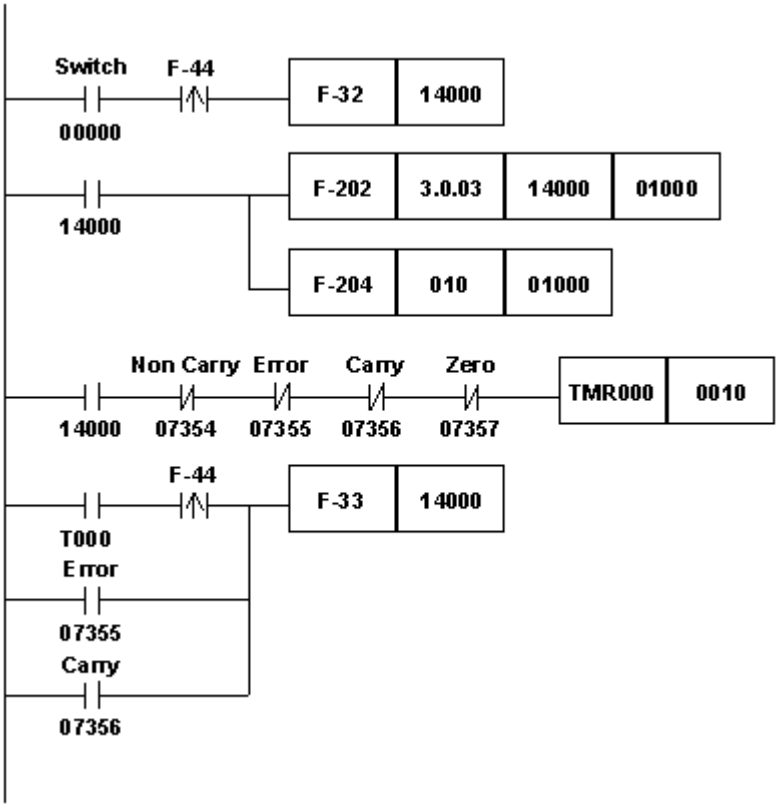
If you are implementing polled and unsolicited communications in Sharp Ethernet module JW-50CM, do the following:

- Configure one device in your CIMPLICITY HMI project for polled data.
- Configure a second device at the same IP address, and a different socket port number for unsolicited data.

See the ***New Satellite JW Series Programmable Controller - A User's Manual - Ethernet Interface Module type JW-50CM Rev 1.0*** for details about configuring the Ethernet module.

Sample Ladder Logic

The sample ladder logic, shown below, sends eight (8) bytes of data, starting at address 1000, from File 0 through channel 0 (address 6000H) to configured station number 3.



The data is sent to the CIMPLICITY HMI computer whenever the **Switch** in the ladder diagram is activated.

Any CIMPLICITY HMI point with a starting point address **0:1000** whose point size is less than or equal to 8 bytes updates when the PLC sends the unsolicited data. For example, if the address 1000 in PLC contains a value of 5, the following point updates occur:

- An ANALOG_8 point at 0:1000 updates to 5.
- An ANALOG_32 point at 0:1000 updates to 5.
- A Boolean point at 0:1000 with an address offset 0 updates to 1.

Sharp TCP/IP Communications Troubleshooting

Please check the CIMPLICITY *Status Log Viewer first* if you encounter problems with your device communications. It often provides helpful hints on communication problems that you might encounter, especially during initial configuration.

This section lists some of those messages, and where appropriate, actions you can take to resolve the problems that cause them.

Other messages for this communications option may also appear in the CIMPLICITY *Status Log Viewer*. If you need help interpreting the messages in the CIMPLICITY *Status Log Viewer*, please contact the CIMPLICITY Technical Support Hotline.

Skip Polling

`Skipping polling around <POINT ID> because request is already pending.`

Cause The Scan Rate you selected is faster than the data can be collected.

This is not an error.

Get Host Name Failed

`Gethostname for <hostname> failed - errno <number>`

Cause The host name and socket port number entered in the *TCP/IP* property page are not configured in your host file.

Resolution To resolve this problem, configure the host name into your computer system as described in step 5 of the Sharp PLC Communications Configuration Checklist. Remember that the names or aliases must match exactly.

Unable to Get A Socket

`Unable to get a socket - errno = <number>`

Cause You do not have enough sockets in your system.

Resolution Contact your system administrator for help in tuning the operating system.

Bind Failed

`Bind() for <hostname> port <port number> failed - REFUSED`

Cause

You can get this message under any of the following circumstances:

- You have not properly configured the socket port number within your CIMPLICITY application with that configured on the PLC.
- At startup, another application is using your port *or* the socket has not cleared from a previous use.
- The CIMPLICITY configuration for the device is inconsistent with that of the programmable controller.

Resolution

To determine if the socket is in use, open a *Command Prompt* window from your project's *Configuration* cabinet, then type the following command:

```
netstat
```

Under "Foreign address", find the line with your configured **`<PLC_name>:<Port_number>`** combination. If the last column says **`TIME_WAIT`**, the connection was previously in use and is in the process of cleaning up. No further action is needed.

If the last column says **`ESTABLISHED`**, the socket port is in use. Check to make sure that you do have a connection (you can usually tell by examining the LEDs on your programmable controller's Ethernet card). If you do not have a connection, contact your system administrator for assistance in locating the application using the port.

If the command yields no information, this usually indicates that the IP address or socket port number configured on the computer does not match the configuration in the programmable controller. Review the configuration on both the computer and programmable controller and correct the mismatch.

Siemens TI Serial Communications

About Siemens TI Serial Communications

The Siemens TI Communications option supports serial communications over RS-232 to Siemens/TI series 505 PLCs. This communications option uses the NITP protocol to communication with the serial port on the TI CPU card.

Siemens TI Serial Communications Supported Devices

Siemens TI Serial Communications supports communication between Windows NT systems and Siemens/TI series 505 PLCs.

Siemens TI Serial Communications Supported Memory Types

The following data types can be read and written from CIMPLICITY communication interface:

Domain Name	Data Type	Direction (as seen by CIMPLICITY software)
Discrete input registers	Digital	Read/Write
Discrete output registers	Digital	Read/Write
Word input registers	Analog	Read/Write
Word output registers	Analog	Read/Write
Constant Memory	Analog	Read/Write
Variable Memory	Analog	Read/Write
Internal Control Relays	Digital	Read/Write
Timer		
Current values	Analog	Read/Write
Preset values	Analog	Read/Write

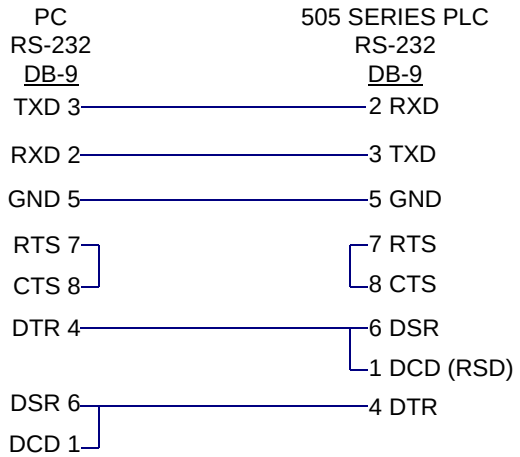
Siemens TI Serial Communications Related Documents

You should have the following documentation available when configuring this interface:

Siemens SIMATIC TI575 Task Code User Manual.

Siemens TI Serial Communications RS-232 Cable Configuration

The RS-232 cable between the CIMPLICITY HMI computer and Siemens/TI 505 Series PLCs must be wired as follows:



Siemens TI Serial Communications Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to Siemens TI Serial communications.

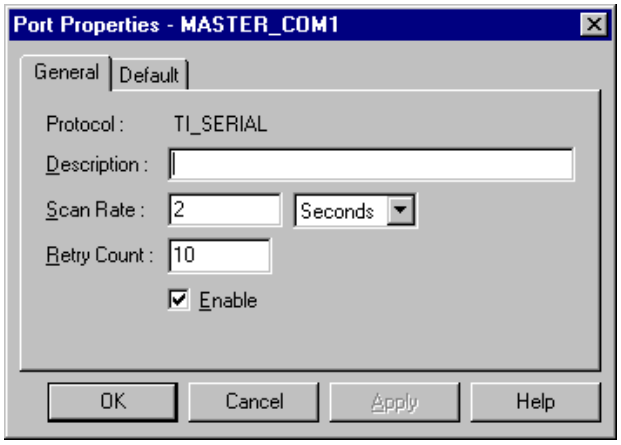
Siemens TI Communications Port Configuration

When you create a new port for Siemens TI Serial communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **TI_SERIAL** from the list of available protocols
2. In the **Port** field, select that communication port that will be used for Siemens TI Serial communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

General Port Properties

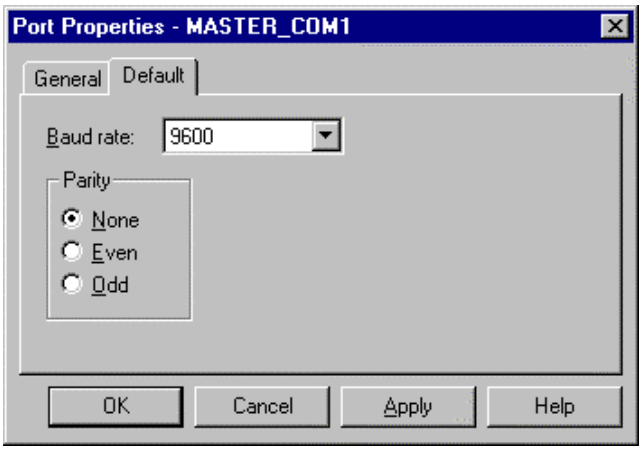


Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rates. You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.
Retry Count	If communications cannot be established to a device on this port, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connection to it. Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.

Enable Check this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Default Port Properties



Use the Default tab in the Port Properties dialog box to enter communications information for the port. You can define the following:

Baud Rate Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.

Parity Select the parity to be used for the communications.

Siemens TI Communications Device Configuration

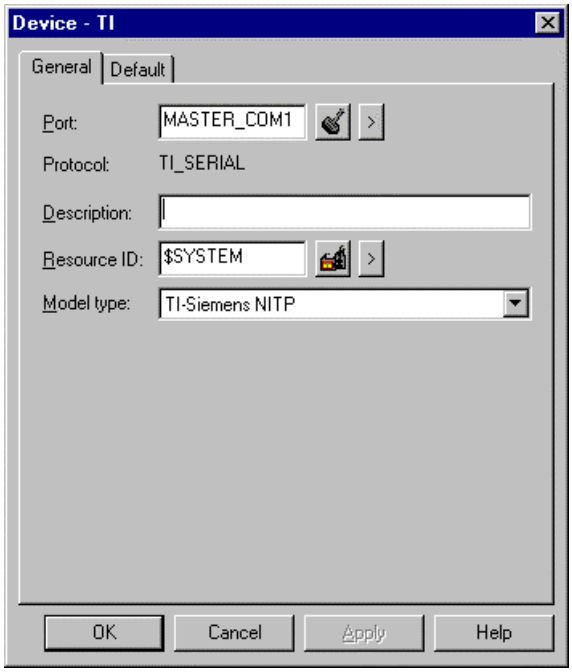
You must configure one device for each Siemens TI device from which you will collect data using Siemens TI Serial communications.

When you create a new device for Siemens TI Serial communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Siemens TI Serial port to be used by the device.

When you select **OK** to create the device, the *Device Properties* dialog box opens.

General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button - - to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button - - to create a new port, edit the current port, or select a port from the list of ports.

Description Enter an optional description to help you identify the device.

Resource Enter a resource that can be associated with this device for alarm generation.

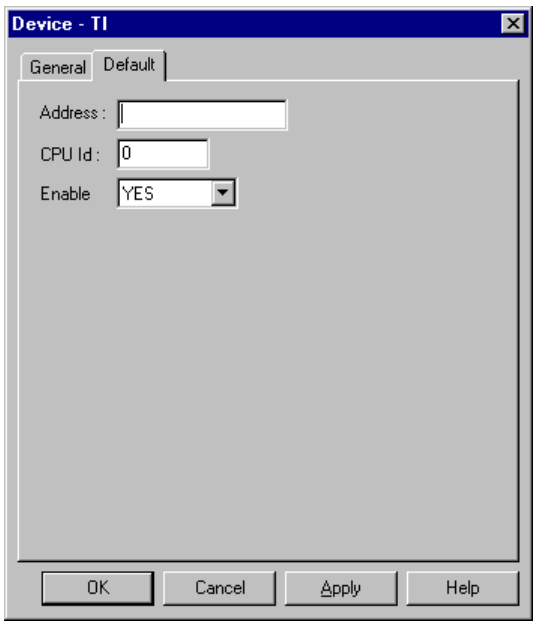
- You can click the Browser button - - to the right of the field to display the list of resources and select one.

You can click the Pop-up Menu button - - to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the only choice is:

TI – Siemens NITP

Default Device Properties



Use the Default tab in the Device dialog box to enter information about communications for the device. You can define the following:

Address	The field is not used.
CPU Id	Enter **0** in the CPU Id field.
Enable	Select YES to enable the device when the project starts. If you enter NO, the device will not be enabled and points associated with the device will be unavailable.

Siemens TI Communications Point Configuration

Once your devices are configured, you may configure points for them. The fields described below have configuration values that are unique to or have special meaning to Siemens TI device communications.

General Point Properties

On the General tab of the Point Properties dialog box, select **Read/Write** for all the memory types.

Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria The update criteria field determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by the Siemens TI driver at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by the Siemens TI driver at regular intervals while users are viewing them.

Address A Siemens TI device point address consists of a one to three character alphabetic field followed by an n-digit decimal-numeric field. The numeric field reflects the offset within an addressing domain, of the particular point. The alphabetic fields map to domains according to the following table:

Enter the point address.

Valid data types, address formats, memory ranges and data types for point addresses are:

Data Memory Type	Address Format	Memory Range	Data Type
Discrete input registers	**X*n***	1 - 2048	Digital
Discrete output registers	**Y*n***	1 - 2048	Digital
Word input registers	**WX*n***	1 - 2048	Analog
Word output registers	**WY*n***	1 - 2048	Analog
Constant Memory	**K*n***	1 - 2048	Analog
Variable Memory	**V*n***	1 - 32768	Analog
Internal Control Relays	**C*n***	1 - 4095	Digital
Timer/counter current values	**TCC*n***	1 - 1024	Analog
Timer/counter preset values	**TCP*n***	1 - 1024	Analog

Note

Since discrete inputs (X) and discrete outputs (Y) share the same memory type, do not use the same register number for a discrete input and a discrete output (for example X0001 and Y0001) or unexpected results may occur.

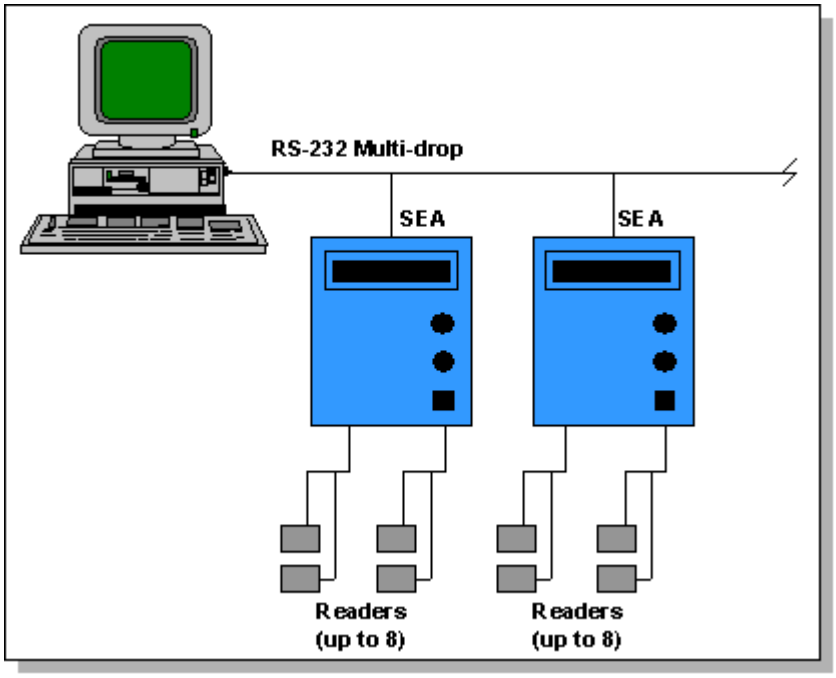
Since word inputs (WX) and word outputs (WY) share the same memory type, do not use the same register number for a word input and a *word* output (for example WXOOOI and WYOOOI) or unexpected results may occur.

Normally TCC and TCP memory types share the number. For example, TCC5 and TCP5 share the same address.

Smarteye Electronic Assembly Communications

About Smarteye Electronic Assembly Communications

The Smarteye Electronic Assembly (SEA) Communications enabler uses the computer's serial port to communicate with Smarteye Electronic Assemblies on a multi-drop RS-232 or RS-422 network.



Using this option, CIMPLICITY software can:

- Poll points at a user-defined scan rate
- Read and write single points
- Issue alarms to users when a device goes down or a reader error occurs
- Monitor reader calibration

This enabler can:

- Support up to thirty-two (32) SEAs per serial port.
- Support up to eight (8) Smarteye readers per SEA.
- Support Polled, Handshake, and Open Loop modes of the SEA.

This enabler supports the following CIMPLICITY HMI features:

- Polled read at user defined rates
- Poll after setpoint
- Triggered reads
- Unsolicited data (only in RS-232 point-to-point configurations)
- Alarm on communications failure
- Server Redundancy configurations

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Smarteye Electronic Assembly Supported Data Types

The Smarteye Electronic Assembly communicates using a change-driven, message oriented protocol. The Smarteye Electronic Assembly device communication enabler processes the SEA messages and uses them to update a virtual device with five regions of memory.

- Labels
- Errors
- Diagnostics
- Conveyance System IDs
- System data

The first four regions each have one location for each reader on the SEA.

Labels

Label values are available in one numeric and 12 string formats. Eight of the string formats include a conveyance system ID.

Errors

Error values are available as a raw error numbers or translated into error messages.

Diagnostics

Diagnostic values correspond to reader calibration values. They are displayed as strings.

Conveyance System IDs

Conveyance System IDs are stored internally in the enabler and are used to build some of the label string formats.

For example, if a label string format includes the conveyance system ID "ABCD" as a suffix, and a label "1234" passes the reader, the format gives a value of "1234ABCD".

System Data

The System region has only two locations: the poll point and the command point.

Poll Point

Each time the Poll point is polled, the enabler queries the SEA for new data and updates other region values with unsolicited data. The value of the Poll point is the number of responses received on one poll cycle.

Command Point

Data written to the Command point is parsed as a command to the SEA or a Smarteye reader. The corresponding command is issued to the SEA.

Smarteye Electronic Assembly Related Documents

You should have the following documentation available when configuring this interface option:

Smarteye Electronic Assembly User Manual

This document is shipped with each SEA. It discusses the issues involved in configuring the communication and operation parameters of the SEA.

Smarteye Electronic Assembly Configuration

Configure the Smarteye Electronic Assembly with the following communication and operational parameters.

Physical Protocol	RS-232
Baud Rate	9600
Parity	None
Communication Mode	Poll, Open Loop or Handshake

See the *Smarteye Electronic Assembly User Manual* for details on setting these parameters

Smarteye Electronic Assembly Application Configuration

When you configure ports, devices, and points that use the Smarteye Electronic Assembly Communications enabler, some fields must contain unique values for the communications to work successfully. These are detailed below.

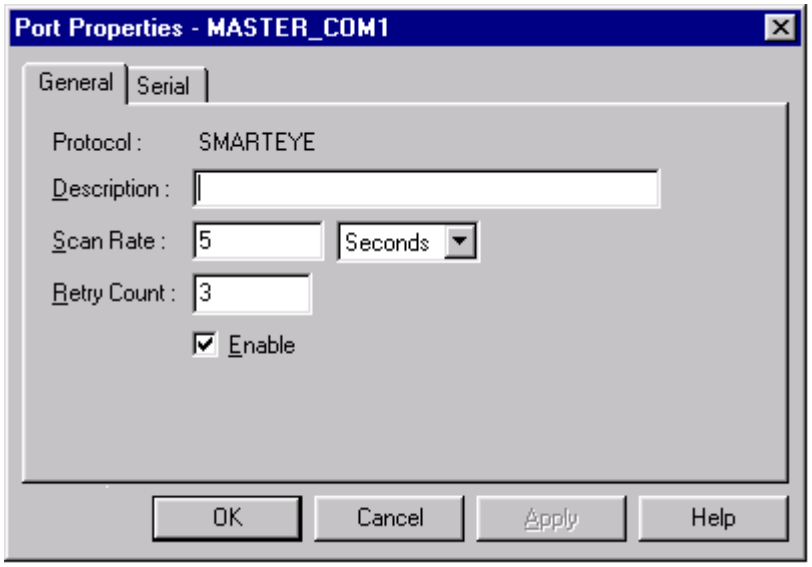
Smarteye Electronic Assembly Port Configuration

When you configure a new port for Smarteye Electronic Assembly communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **SMARTEYE** from the list of protocols.
2. In the **Port** field, select the communication port that will be used for Smarteye Electronic Assembly communications.

When you select **OK** to create the port, the *Port Properties* dialog box opens.

SEA General Port Properties



Use the General properties to enter general information for the port. You can define the following:

Description Enter an optional description to help you identify the port.

Scan Rate Enter the base scan rate for the port. Point scan rates are multiples of the base rate.

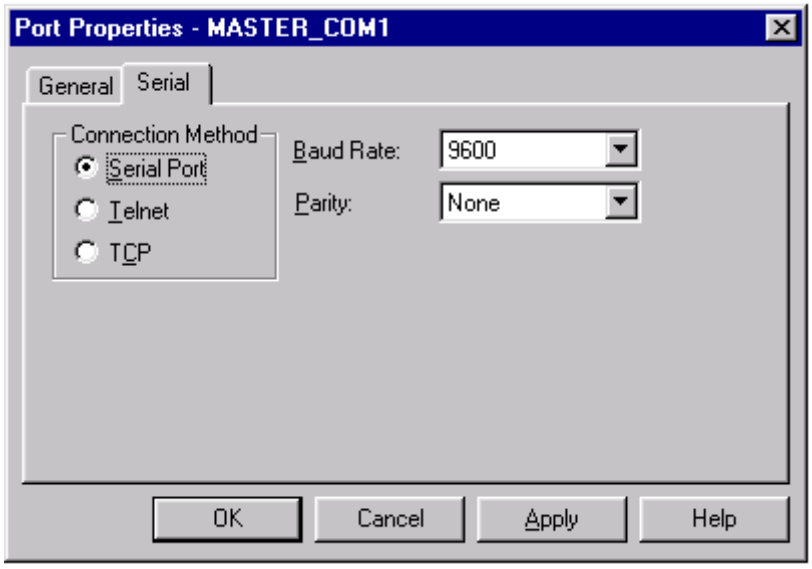
You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.

Retry Count If communications cannot be established, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it.

Enter the number of scans to wait before attempting to a device on this port after a communications error is detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

SEA Serial Port Properties - Serial Connection



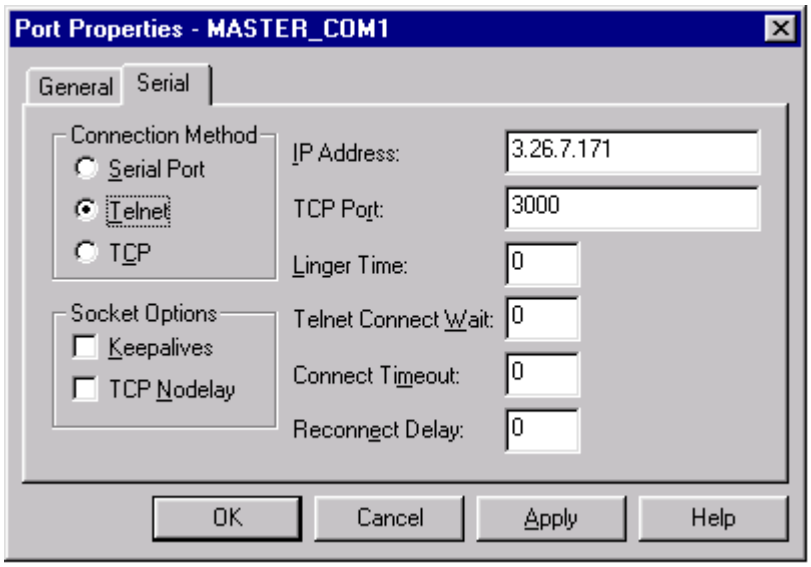
If you select the serial port connection method, you need to define the following:

Baud Rate Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.

Parity Select the parity to be used for communications.

Remember that you must configure the same baud rate, data bits, parity, stop bits and flow control for all PLCs using the serial port.

SEA Serial Port Properties - Telnet or TCP Connection



If you select the Telnet or TCP connection method, you need to define the following:

Socket Options	Set the **Keepalives** check box to use keepalives to detect the loss of the terminal server. Clear the check box if you do not want to use keepalives to detect the loss of the terminal server. Set the **TCP Nodelay** check box if you want to set the Nodelay flag on the socket. Clear the check box if you do not want to set the Nodelay flag.
IP Address	Enter the IP address of the terminal server.
TCP Port	Enter the port number of the TCP port on the terminal server.
Linger Time	Enter the time in seconds to wait after closing the socket before aborting the socket.
Telnet Connect Wait	Enter the time in seconds to wait for the Telnet protocol to initialize.
Connect Timeout	Enter the time in seconds to wait for the TCP connection to form.
Reconnect Delay	Enter the time in seconds to wait before attempting to reconnect to a device. If you set this value to zero and the terminal server is not available, no attempts will be made to reconnect to the terminal server.

Terminal Server Setup

Each port on the terminal server to which SEA is connected must be configured for TCP/IP communications. Use the following steps to configure your terminal server:

1. Log into your terminal server, and set privileged mode by issuing the following command. Enter the privileged password when prompted (typically "system"):

   ```
   > set priv
   Password>
   ```

2. Enter the following command so that the permanent database and the operational database will be updated when a **`define`** command is issued:

   ```
   >> set server change enabled
   ```

3. For each port to which a marquee is attached, enter the following set of commands where:

   `<port>` is the actual port number to which the marquee is attached. Note that it is possible to specify a range of port numbers instead of a single port (for example, *1-10* signifies ports 1 through 10).

   `<ip_port>` is the telnet port number.

   `<parity>` is odd, even, or none.

   `<stop bits>` is the number of stop bits.

   `<speed>` is the baud rate of the marquee.

```
>> define port <port> access remote
>> define port <port> telnet remote <ip_port>
>> define port <port> telnet transmit immediate
>> define port <port> parity <parity>
>> define port <port> character size 8
>> define port <port> stop bits <stop bits>
>> define port <port> autobaud disabled
>> define port <port> speed <speed>
>> define port <port> line editor disabled
>> define port <port> telnet csi escape enabled
>> define port <port> telnet binary session mode passall
>> define port <port> loss notification disabled
>> define port <port> autoprompt disabled
>> define port <port> verification disabled
>> define port <port> outboundsecurity disabled
>> define port <port> broadcast disabled
>> define port <port> default session mode transparent
>> define port <port> internet tcp keepalive 2
```

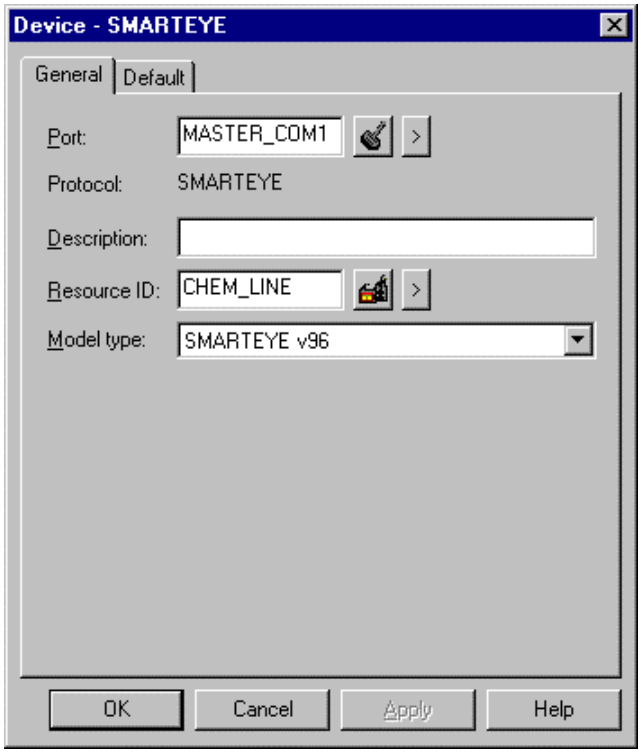
Smarteye Electronic Assembly Device Configuration

When you create a new device for Smarteye Electronic Assembly Communications, enter the following information in the *New Device* dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the SEA port to be used by the device.

When you select **OK** to create the port, the *Device Properties* dialog box opens.

SEA General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- You can click the Browser button to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button to create a new port, edit the current port, or select a port from the list of ports.

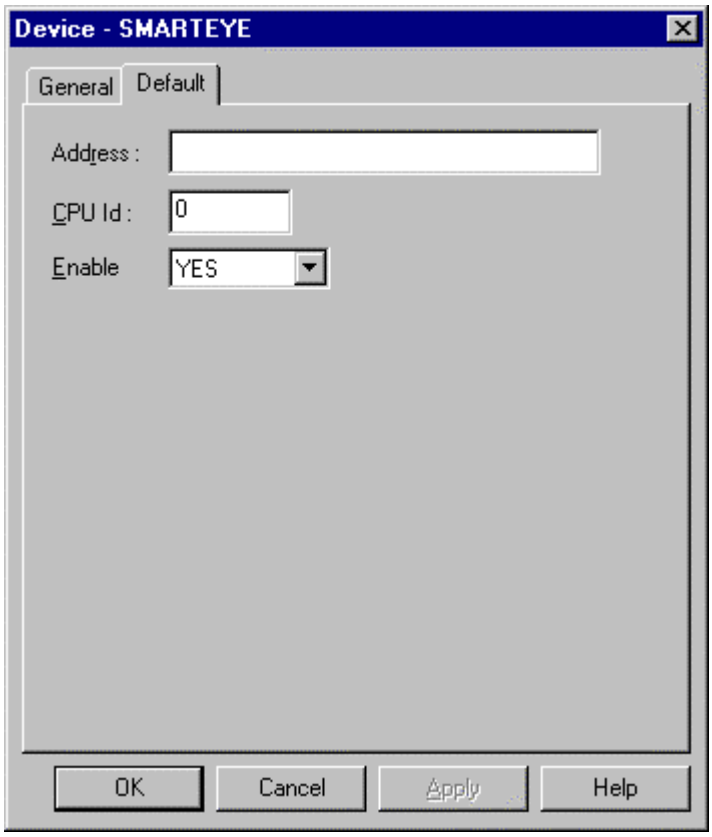
Description Enter an optional description to help you identify the device.

Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type There is only one model, **SMARTEYE v96**.

SEA Default Device Properties



Use the Default tab in the Device dialog box to enter information about Smarteye Electronic Assembly communications for the device. You can define the following:

Address Enter the octal address for the device. The address is an octal value between 000 and 370 ending in 0.

CPU ID *Not used.*

Enable Select **Yes** in this box to enable the device when the project starts. Select **No** in this box to disable the device. Points associated with the device will be unavailable.

Point Configuration

When you define a point, the following fields have values that are unique to or have special meaning for Smarteye Electronic Assembly communications:

SEA General Point Properties

On the General tab in the Point Properties dialog box, you may configure points for **Read** or **Read/Write** access as follows:

Region	Access type
Label	Read
Error	Read
Diagnostic	Read
Conveyance System	Read/Write
System	Read/Write

Note

In the System region, only the command point is writeable.

SEA Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria: The update criteria you use determines how the data will be requested.

Enter **On Scan** or **On Change** for points whose values should be polled by the Smarteye Electronic Assembly driver at regular intervals.

Enter **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by the Smarteye Electronic Assembly driver at regular intervals while users are viewing them.

Enter **Poll Once** for conveyance system IDs and command points.

Enter **Unsolicited** for all other points.

Address: Point address requirements are region-dependent. Valid regions are:

Labels
Errors
Diagnostics
Conveyance System IDs
System data

Scan Rate For poll points, set this to some low number as required.

For all other points, this field is ignored.

Poll After Set For conveyance system IDs and command points, set this check box

Point Address Formats

The Smarteye Electronic Assembly supports the following address formats:

Labels

The address format for Labels is:

L<READER>.<FORMAT>

where:

<READER> is the reader number from 0 to 7.

<FORMAT> is one of the following 13 string format specifiers. The string format specifiers indicate the justification of the label value (Left or Right), fill character (Blank or Zero), and the position of the conveyance system ID (None, Prefix, or Suffix).

Format	Data Type	Elements	Example
NUM	INT	1	**1234**
LBN	STRING	5	**"1234 "**
LBP	STRING	9	**"ABCD1234 "**
LBS	STRING	9	**"1234ABCD "**
LZN	STRING	5	**"1234 "**
LZP	STRING	9	**"ABCD1234 "**
LZS	STRING	9	**"1234ABCD "**
RBN	STRING	5	**" 1234"**
RBP	STRING	9	**"ABCD 1234"**
RBS	STRING	9	**" 1234ABCD"**
RZN	STRING	5	**"01234"**
RZP	STRING	9	**"ABCD01234"**
RZS	STRING	9	**"01234ABCD"**

For example, **L0.NUM** is the label number for reader 0.

Note

If conveyance system IDs are less than four characters, string values are padded on the right with blanks to fill the required number of spaces.

Errors

The address format for Errors is:

E<READER>.<FORMAT>

where:

<**READER**> is the reader number from 0 to 7

<FORMAT> is one of two format specifiers in the following table

Format	Data Type	Elements
NUM	INT	1
STR	STRING	80

Note

See **Smarteye Reader Errors** for details on interpreting error codes and configuring alarms for reader errors.

Diagnostics

The address format for Diagnostics is:

D<READER>

where **<READER>** is the reader number from 0 to 7.

Diagnostic strings are 28-element STRING points.

Conveyance System IDs

The address format for Conveyance System IDs is:

C<READER>

where **<READER>** is the reader number from 0 to 7.

Conveyance IDs are 4-element STRING points. If not set, they default to empty; that is, a string of no characters.

System Data

The address format for System Data is:

S<LOCATION>

where **<LOCATION>** is 0 or 1 to select the Poll or Command point.

0 to select the Poll point

1 to select the Command point

Note

Exactly one poll point *must* be configured for each system device.

Additional Poll Point Configuration

You must also configure the following for a Poll point:

Data Type is INT.

Elements is 1.

Additional Command Point Configuration

You must also configure the following for a Command point:

Data type is STRING.

Elements is 2.

Conveyance System IDs

The Conveyance System ID is a string of up to four characters, which is appended to label values for certain label formats. Each label reader has a Conveyance System ID associated with it.

The device communication enabler initializes Conveyance System IDs to an empty string when it starts up and accepts setpoint requests to assign them at run time.

One mechanism for these setpoints is to use the Basic Control Engine, create events to check for the IDs being blank, and associated actions to set them to the desired value. In this way, each time the enabler restarts, the desired Conveyance System IDs are initialized.

Command Points

Commands may be sent to the Smarteye Electronic Assembly via command points. A command point is configured as a 2-character string point at address S1.

The first character of the command point is the command code. The second character specifies the reader number for certain commands.

The following commands are directed at the SEA and do not require a reader ID.

Code	Command Description
R	Restart. Initialize all readers on-line.
B	Box poll. Request message from any reader in the SEA.
A	Ack. Acknowledge the previous transmission.
N	Nak. Negatively acknowledge the previous transmission.

The communication enabler uses these commands to interact with the SEA. Generally, they should not be used interactively.

The following commands are directed at specific readers and do require a reader ID.

Code	Command Description
I	Initialize the reader on-line
S	Status inquiry regarding reader
C	Create a diagnostic message for the next label at the reader
L	Lock in diagnostic for all labels at the reader
U	Unlock diagnostic at reader
F	Take reader off-line

For example, sending **"C2"** to the command point of an SEA causes the value for the next label to pass reader two to be followed by a diagnostic message.

Advanced Configuration Topics

The operation of the Smarteye Electronic Assembly Communication enabler can be controlled through global parameters. This section discusses the global parameters used by the enabler and their settings. *See the CIMPLICITY HMI Base System User's Manual (GFK-1180) for details on setting global parameters.*

<port>_LOG_WARNING

By default, all Warning messages are logged to the project's Status Log file.

To eliminate or redirect Warning messages, add the following line to your global parameters file:

<port>_LOG_WARNING|1|<log_file_location>

where:

<port> is the name of the port used by the enabler.

<log_file_location> identifies the file to which the Warning messages will be redirected. You can enter one of the following in this field:

- **COR_STATUS** - Warning messages are logged to the projects Status Log (this is the default).
- **STD_OUT** - Warning messages are logged to the processes standard output file
- **NONE** - Warning messages are not logged.

<port>_MODE

Ordinarily, the enabler polls each configured device at intervals determined by the port base scan and the device's poll point scan rate multiplier. This is Polled mode.

The enabler may also be configured for Listen Only or Handshake mode.

In Listen Only mode, the enabler listens for messages from SEAs but does not poll for data or process command points. This is useful if the SEA is configured for Open Loop mode or if another system is polling the SEAs during an initial installation or changeover between systems.

In Handshake mode, the enabler listens for and acknowledges messages and processes command points, but does not poll for data. This may reduce communication and processing overhead.

To configure the mode that the enabler operates in, add the following line to your global parameters file:

<port>_MODE|1|<mode>

where **<port>** is the name of the port used by the enabler, (for example, **COM1**) and **<mode>** is **LISTEN** or **HANDSHAKE**.

<port>_POLL_LIMIT

Each poll cycle, the enabler will poll each device for up to eight new messages. This is the *poll limit*. In some circumstances, performance may be improved by adjusting this poll limit.

To set the poll limit, add the following line to your global parameters file:

```
<port>_POLL_LIMIT|3|<limit>
```

where **<port>** is the name of the port used by the enabler and **<limit>** is the number of messages you want processed each poll cycle.

<port>_RESTART_SEA

Each time the enabler starts up in Polled or Handshake mode, and each time there is a communication error in Polled mode, the enabler sends a RESTART command to the Smarteye Electronic Assembly (SEA). This RESTART command flushes any buffered label messages in the SEA.

To preserve messages for the labels that are read while the enabler is not running, add the following line to your global parameters file:

```
<port>_RESTART_SEA|1|FALSE
```

where **<port>** is the name of the port used by the enabler.

To restore the default behavior of restarting the SEA when the enabler starts or detects an error, change the "FALSE" to "TRUE" or remove the line from the global parameters file.

SE_LABEL_LEN

The default label length is 5 characters. Labels are zero-filled or blank-filled to this length.

If all the labels in your project are all the same length, you can use this global parameter to set the label length and eliminate zero and blank filling of labels. To configure a new label length for your project, add the following line to your global parameters file:

```
SE_LABEL_LEN|1|<label_length>
```

where **<label_length>** is 3, 4 or 5. If a label is read that has a length greater than this, a FAILURE error message will be logged to the Status Log.

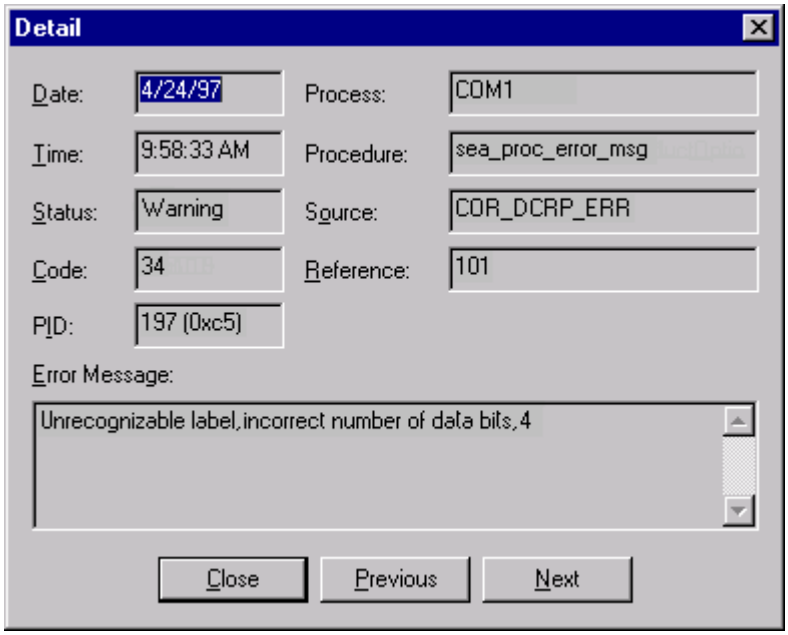
Smarteye Reader Errors

By default, all reader errors are logged in the *Status Log*. In addition, reader errors may be monitored in via CIMPLICITY points and alarms:

- You may configure points to hold the error code and error message for each reader. These points may be displayed on a **CimView** screen, logged using the data logger, etc.
- You may configure alarms for error code points that will be displayed in the Alarm Viewer.

Status Log Entries

A typical Status Log entry looks like:

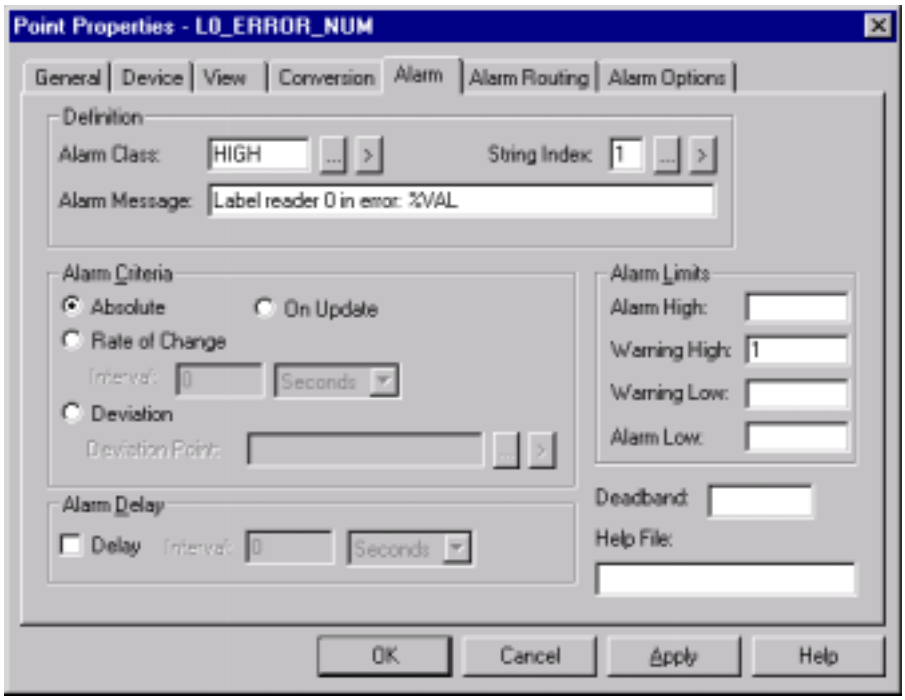


The following fields have special meaning for Smarteye reader errors

Process	The port used to communicate with the reader
Code	The error code returned by the Smarteye Electronic Assembly. Refer to the ***Smarteye Electronic Assembly User Manual*** for help in interpreting this code. This same code appears in a **NUM** format error point configured for the reader.
Reference	The octal address of the Smarteye reader. The first two digits indicate the Smarteye Electronic Assembly, and the last digit is the reader number on that SEA. For example, a reference of 245 would indicate an error on reader 5 of the SEA at address 240.
Error Message	This is the message that appears in a **STR** format error point configured for the reader.

Configuring Reader Error Alarms

If you configure numeric points to hold reader error codes, you may wish to configure alarms on those points to generate entries in the *Alarm Viewer* when a reader error occurs. The following is an example of such a configuration:



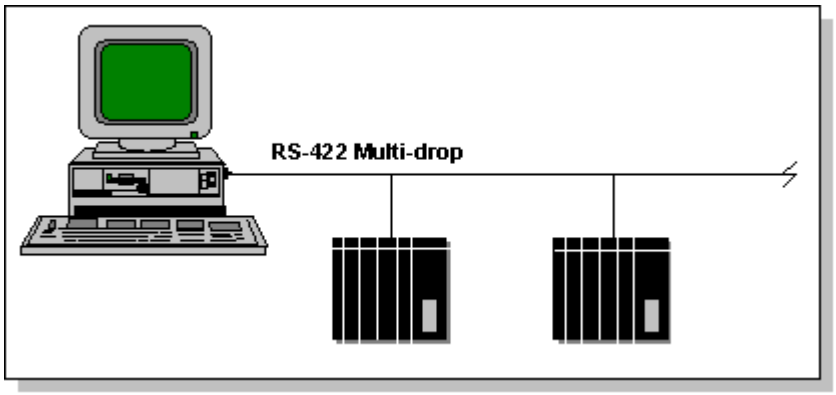
SNP and SNPX Communications

About SNP and SNPX Communications

The SNP Communications enabler uses the Series Ninety Protocol (SNP) to communicate with Series 90 controllers over a serial line.

The SNPX Communications enabler uses the SNPX protocol to communicate with Series 90-30 controllers over a serial line.

SNP and SNPX are half-duplex protocols that uses the RS-485 (enhanced version of RS-422) and RS-232 electrical interfaces. These protocols permit communication between one master and one or more slaves. Communication between CIMPLICITY HMI software and Series 90 controllers may be set up as a point-to-point connection or a multidrop configuration. Connections may be established on the RS-485 CPU port of the Series 90 or via the CMM card.



Both enablers support the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Poll after setpoint
- Triggered reads
- Analog deadband
- Alarm on communications failure
- Server Redundancy configurations

Both enablers support the following data types:

- Signed 8, 16, and 32 bit integer
- Unsigned 8, 16, and 32 bit integer
- Floating point
- Text
- Arrays

SNP and SNPX Performance Comparison

For point-to-point communication, the SNPX protocol is 5 to 10 percent faster than SNP protocol if the average packet size is greater than 100 bytes. The difference becomes smaller when the average packet size get bigger.

The SNPX protocol is 5 or even 10 times faster than the SNP protocol in multi-drop communications.

- In multi-drop communications, the SNPX protocol supports broadcast-attach which makes the SNPX device communications option attach to all the PLCs at the same time. After attaching to all the PLCs, the SNPX device communications option can send a request to any PLC in the network without re-attaching to it.
- Currently, it takes approximately 0.6 second for the SNP communications option to attach to a PLC each time the communications option sends a data request.

Supported SNP Devices

The SNP Communications enabler supports reading and writing point data to the following Series 90 controllers:

Series 90 Micro PLCs	S90-30 Model 351
S90-20 Model 211	S90-70 Model 731
S90-30 Model 301	S90-70 Model 732
S90-30 Model 311	S90-70 Model 771
S90-30 Model 313	S90-70 Model 772
S90-30 Model 321	S90-70 Model 781
S90-30 Model 323	S90-70 Model 782
S90-30 Model 331	S90-70 Model 914
S90-30 Model 341	S90-70 Model 924

Supported SNPX Devices

The SNPX Communications enabler supports reading and writing point data to the following Series 90-30 controllers:

S90-30 Model 301	S90-30 Model 331
S90-30 Model 311	S90-30 Model 341
S90-30 Model 313	S90-30 Model 351
S90-30 Model 323	

Supported SNP and SNPX Memory Types

Note: If you add a block to the programmable controller or resize domains, you must stop and restart the SNP Communications Enabler in order for it to see the changes.

Data may be read from the following memory types:

%AI	Analog Inputs	%R	Registers
%AQ	Analog Outputs	%S	Discretes
%G	Genius Global Data	%SA	Discretes
%I	Discrete Inputs	%SB	Discretes
%M	Discrete Internals	%SC	Discretes
%Q	Discrete Outputs	%T	Discrete Temporaries

Data may be written to the following memory types:

%AI	Analog Inputs	%M	Discrete Internals
%AQ	Analog Outputs	%Q	Discrete Outputs
%G	Genius Global Data	%R	Registers
%I	Discrete Inputs	%T	Discrete Temporaries

Caution: Do not write data into the system registers (%S, %SA, %SB, and % SC). Doing so may interfere with the normal operation of the programmable controller.

SNP Hardware Configuration Requirements

Original CMM cards did not support the SNP protocol. The following versions (or later) of software/hardware are needed to use this feature. Other modules in the Series 90 CPU rack may need to be upgraded when upgrading the CPU firmware.

Series 90-30:

The versions for Series 90-30 are:

CPU	IC693CPU331K	V3.03 or higher firmware.
	IC693CPU341	Version 4.02 or higher firmware.

Note: 331, 341 and 351 CPUs are the only members of the 90-30 family that support a CMM card.

CMM	IC693CMM311D	

Version 3.50 or higher version of Logicmaster 90-30 Software Package Programmer and Configurator. This is optional if a Hand-Held Programmer for Series 90-30 and 90-20 Programmable Controllers is available. The Hand-Held Programmer may be used to configure the CMM.

IC641SWP301L	3.5I 2DD, 5.25I 2S/HD (WSI Version)
IC641SWP304J	5.25I 2S/2D (WSI Version)
IC641SWP306F	3.5I 2DD, 5.25I 2S/HD Standard Serial COM port
IC641SWP307F	5.25I 2S/2D Standard Serial COM port

Series 90-70 family:

All CPU modules require V4.02 or higher firmware.

CPU	IC697CPU731N	Series 90-70 Model 731
	IC697CPU732C	Series 90-70 Model 732
	IC697CPU771L	Series 90-70 Model 771
	IC697CPU772C	Series 90-70 Model 772
	IC697CPU781D	Series 90-70 Model 781
	IC697CPU782D	Series 90-70 Model 782
	IC697CPM914	Series 90-70 Model 914
	IC697CPM924	Series 90-70 Model 924
CMM	IC697CMM711E	PCMA2 H/W only
	IC697CMM711EX	PCMA1 H/W only

Version 4.01 or higher of the Logicmaster 90-70 Software Package Programmer and Configurator is required to configure a CMM card.

IC641SWP701L	3.5I 2DD, 5.25I 2S/HD (WSI Version)
IC641SWP704J	5.25I 2S/2D (WSI Version)
IC641SWP706B	3.5I 2DD, 5.25I 2S/HD Standard Serial COM port

Series 90 Micro PLCs

All CPU models require V2.1 or higher firmware.

The following PLCs have been qualified for use with the SNP Communications option.

CPU	IC693UDR001HP1	
	IC693UDR001GP1	

SNPX Hardware Configuration Requirements

SNPX supports communications with Series 90-30 PLCs. The versions for Series 90-30 are:

CPU	IC693CPU331K	V3.03 or higher firmware.
	IC693CPU341	Version 4.02 or higher firmware.

Note: 331, 341 and 351 CPUs are the only members of the 90-30 family that support a CMM card.

CMM	IC693CMM311D	

Version 3.50 or higher version of Logicmaster 90-30 Software Package Programmer and Configurator. This is optional if a Hand-Held Programmer for Series 90-30 and 90-20 Programmable Controllers is available. The Hand-Held Programmer may be used to configure the CMM.

IC641SWP301L	3.5I 2DD, 5.25I 2S/HD (WSI Version)
IC641SWP304J	5.25I 2S/2D (WSI Version)
IC641SWP306F	3.5I 2DD, 5.25I 2S/HD Standard Serial COM port
IC641SWP307F	5.25I 2S/2D Standard Serial COM port

Required SNP and SNPX Documents

You should have one or more of the following documents available when configuring your SNP or SNPX communications network:

Series 90-20 Programmable Controller User's Manual (GFK-0501)

Series 90-30 Programmable Controller Installation Operator's and User's Manual (GFK-0356)

Series 90-70 Programmable Controller Installation Manual (GFK-0262)

If you are using a CMM card, you should also have the following manual available:

Series 90 Programmable Controller Serial Communications User's Manual (GFK-0582)

SNP and SNPX Hardware Installation (External)

The CIMPLICITY SNP and SNPX Communications enablers support point-to-point and multidrop configurations of Series 90 controllers.

When you configure the SNP port, you will need to know the baud rate and parity being used by the Series 90 programmable controllers. In addition, CIMPLICITY software uses 8-bit characters with 1 stop bit for communicating with Series 90 controllers.

If a CMM card is used, it may be desirable to configure an SNP ID different from that of the attached port. The *Series 90 Programmable Controller Serial Communications User's Manual* (GFK-0582) describes the ladder logic required to change the SNP ID. If this is done, be ***sure*** that the Series 90 is in a RUN state, and the SNPIO ladder logic has successfully completed before attempting to communicate with the device via CIMPLICITY software or device communications will fail.

In general, a baud rate of 9600 or less is recommended. If both ports on the CMM module are in use, the baud rate ***must*** be 9600 or less.

Caution: Serial ports on the Series 90 family are ***not*** isolated. Potential differences above 7 volts will cause damage. Isolators should be employed on long distance runs to guard against equipment damage.

The Installation manuals shipped with the Series 90 controller provide information under *Cabling* for connecting to the attached port of Series 90 controllers. The Serial Communications manual provides information for connecting to the CMM port available for some Series 90s.

When you refer to this documentation, use the following guidelines:

- Computers with 9-pin serial connectors should follow the cabling diagrams for IBM-AT compatible Personal Computers.

On the following pages are several sample configurations with cabling directions. A more comprehensive description is available in the Installation manuals listed above. Refer to these manuals for cable and connector information as well as information regarding the converters.

Cabling Diagrams for Point-to-Point Configurations

The following diagrams illustrate point-to-point configurations using the RS-232/RS-422 Converter (IC690ACC900) or the RS-422/RS-232 Isolated Repeater/Converter (IC655CCM590):

Diagram	Converter	Connected to:	Cables
A	IC690ACC900	Series 90 RS-485 CPU port	A or B, C
B	IC690ACC900	Series 90 RS-485 CPU port	A or B, D
C	IC690ACC900	Series 90 RS-485 CPU port	A or B, E
D	IC690ACC900	Series 90 RS-485 CPU port	A or B, F
E	IC690ACC900	Series 90 RS-485 CMM port	A or B, G
F	IC655CCM590	Series 90 RS-485 CPU port	A or B, H
G	IC655CCM590	Series 90 RS-485 CPU port	A or B, I
H	IC655CCM590	Series 90 RS-485 CMM port	A or B, J

Diagram A

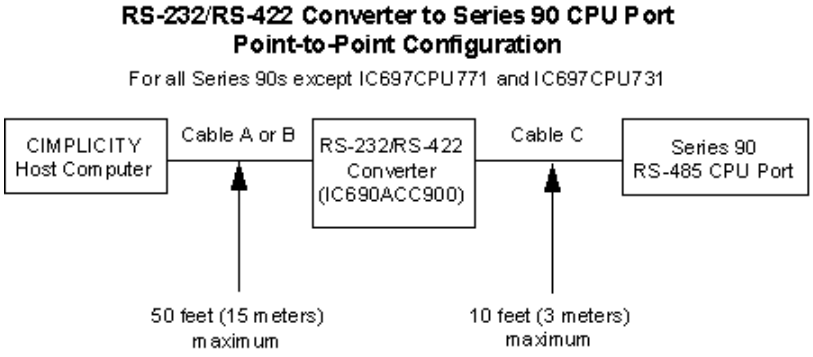

RS-232/RS-422 Converter to Series 90 CPU Port
Point-to-Point Configuration
For all Series 90s except IC697CPU771 and IC697CPU731
CIMPLICITY Host Computer
Cable A or B
RS-232/RS-422 Converter (IC690ACC900)
Cable C
Series 90 RS-485 CPU Port
50 feet (15 meters) maximum
10 feet (3 meters) maximum

Diagram B

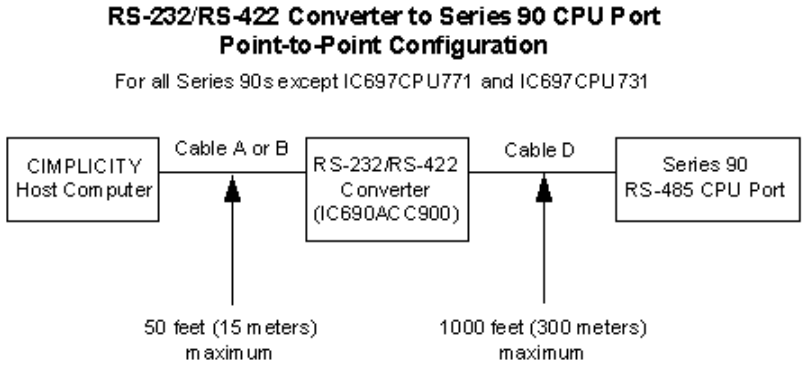

RS-232/RS-422 Converter to Series 90 CPU Port
Point-to-Point Configuration
For all Series 90s except IC697CPU771 and IC697CPU731
CIMPLICITY Host Computer
Cable A or B
RS-232/RS-422 Converter (IC690ACC900)
Cable D
Series 90 RS-485 CPU Port
50 feet (15 meters) maximum
1000 feet (300 meters) maximum

Diagram C

RS-232/RS-422 Converter to Series 90 CPU Port
Point-to-Point Configuration

For Series 90 IC697CPU771 and IC697CPU731 only

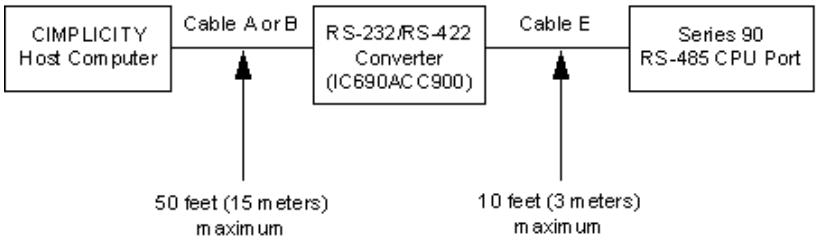


Diagram D

RS-232/RS-422 Converter to Series 90 CPU Port
Point-to-Point Configuration

For Series 90 IC697CPU771 and IC697CPU731 only

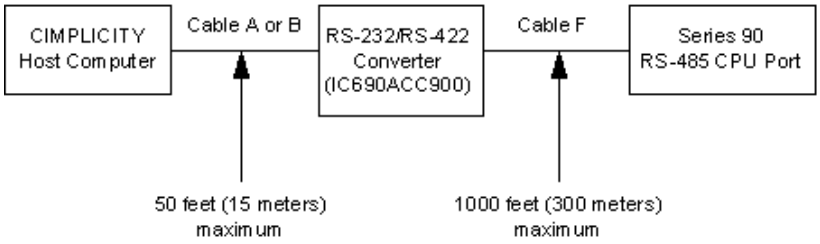
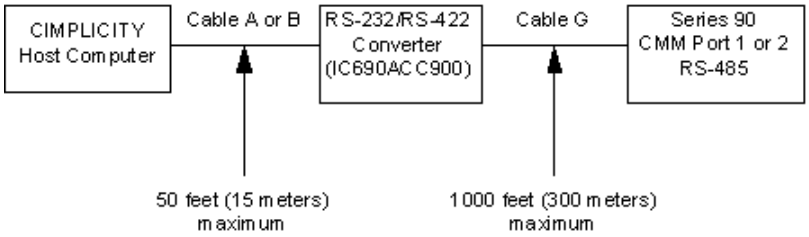


Diagram E

RS-232/RS-422 Converter to Series 90 CMM Port
Point-to-Point Configuration



Note: on the Series 90-30 CMM, only Port 2 supports RS-422/RS-485

Diagram F

RS-232/RS-422 Isolated Converter to Series 90 CPU Port
Point-to-Point Configuration

For all Series 90s except IC697CPU771 and IC697CPU731

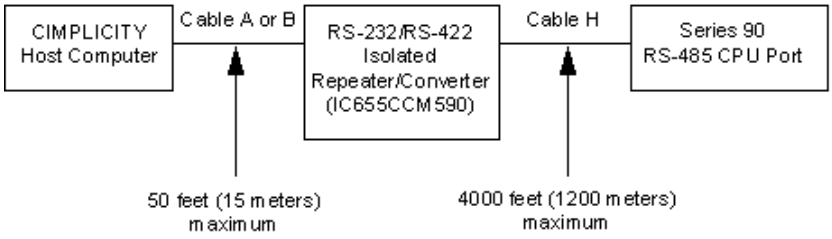


Diagram G

RS-232/RS-422 Isolated Converter to Series 90 CPU Port
Point-to-Point Configuration

For IC697CPU771 and IC697CPU731 only

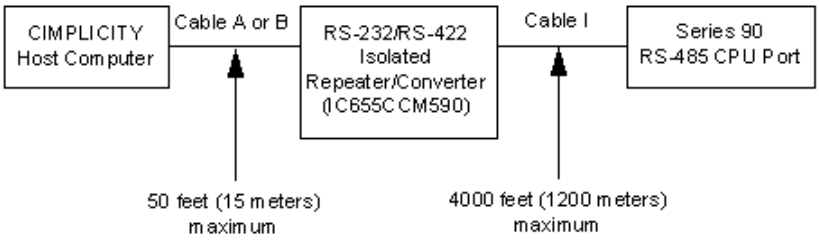
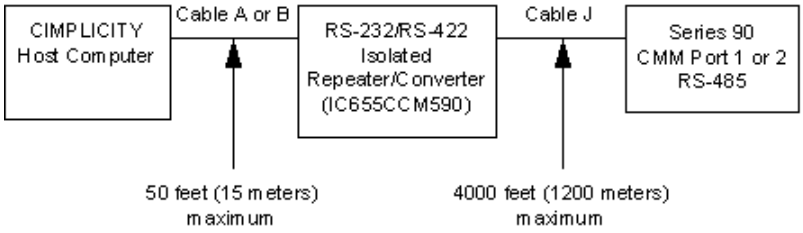


Diagram H

RS-232/RS-422 Isolated Converter to Series 90 CMM Port
Point-to-Point Configuration



Note: on the Series 90-30 CMM, only Port 2 supports RS-422/RS-485

Cabling Diagrams for Multidrop Configurations

The following diagrams illustrate multidrop configurations using the RS-232/RS-422 Converter (IC690ACC900) or the RS-422/RS-232 Isolated Repeater/Converter (IC655CCM590)

Diagram	Converter	Last Station:	Cables
I	IC690ACC900	Series 90 RS-485 CPU port (not IC697CPU771 or IC697CPU731)	A or B, K
J	IC690ACC900	Series 90 RS-485 CPU port (IC697CPU771 or IC697CPU731	A or B, L
K	IC690ACC900	Series 90 RS-485 CMM port	A or B, M
L	IC655CCM590	Series 90 RS-485 CPU port (not IC697CPU771 or IC697CPU731)	A or B, N
M	IC655CCM590	Series 90 RS-485 CPU port (IC697CPU771 or IC697CPU731)	A or B, O
N	IC655CCM590	Series 90 RS-485 CMM port	A or B, P

Diagram I

RS-232/RS-422 Converter to Series 90 CPU Port
Multidrop Configuration

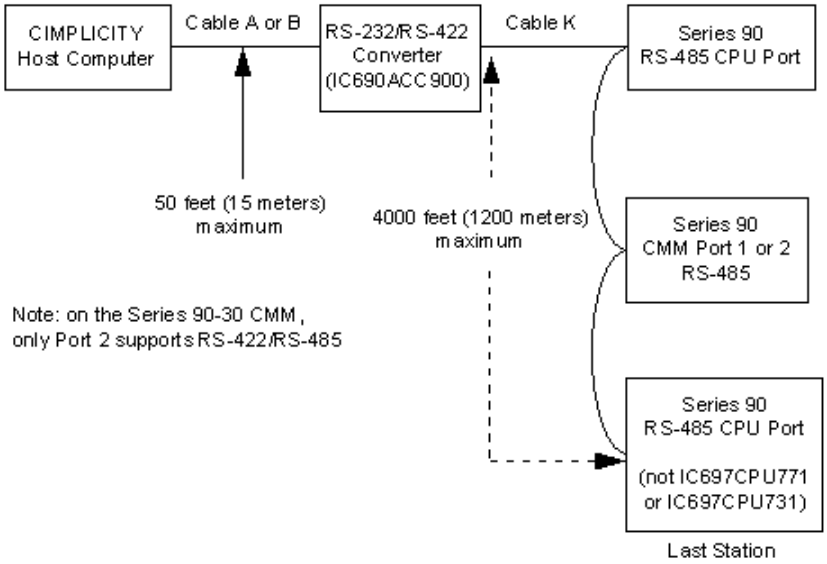


Diagram J

RS-232/RS-422 Converter to Series 90 CPU Port
Multidrop Configuration

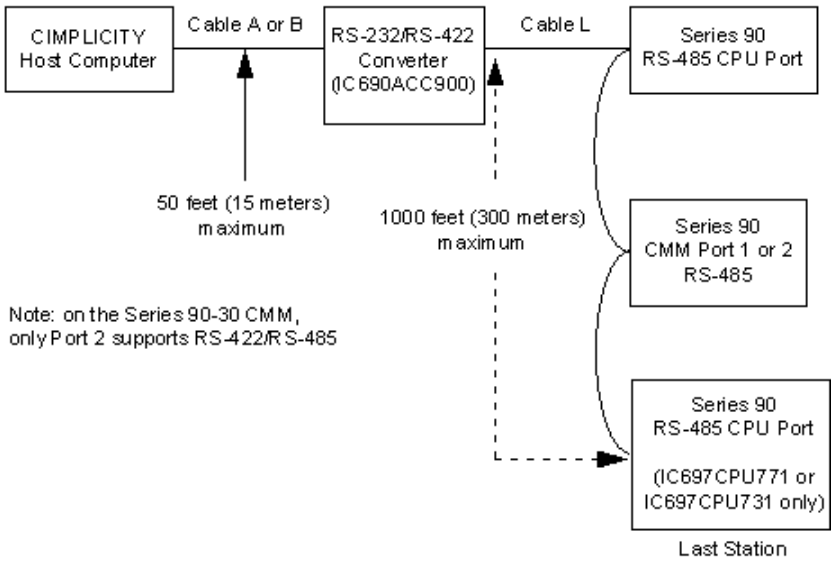


Diagram K

RS-232/RS-422 Converter to Series 90 CPU Port
Multidrop Configuration

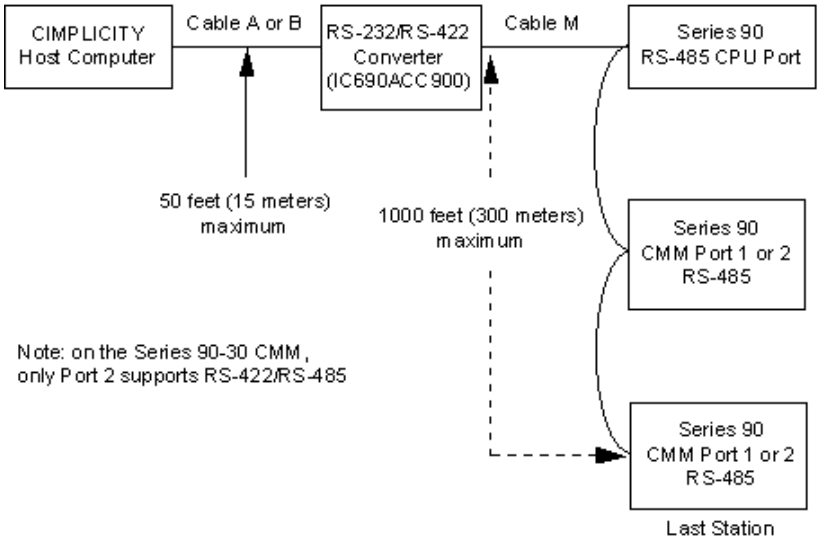


Diagram L

RS-422/RS-232 Isolated Repeater/Converter to Series 90 PLC Ports Multidrop Configuration

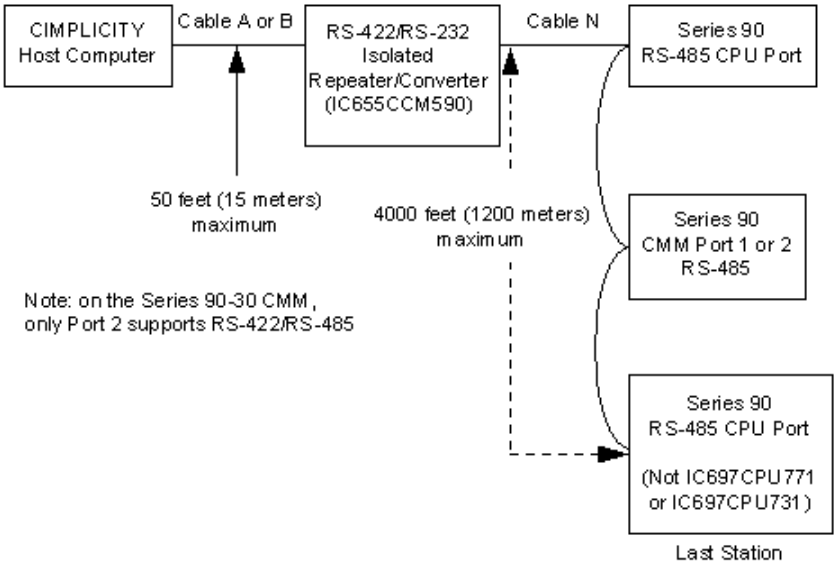

CIMPLICITY Host Computer
Cable A or B
RS-422/RS-232 Isolated Repeater/Converter (IC655CCM590)
Cable N
Series 90 RS-485 CPU Port
50 feet (15 meters) maximum
4000 feet (1200 meters) maximum
Series 90 CMM Port 1 or 2 RS-485
Note: on the Series 90-30 CMM, only Port 2 supports RS-422/RS-485
Series 90 RS-485 CPU Port
(Not IC697CPU771 or IC697CPU731)
Last Station

Diagram M

RS-422/RS-232 Isolated Repeater/Converter to Series 90 PLC Ports Multidrop Configuration

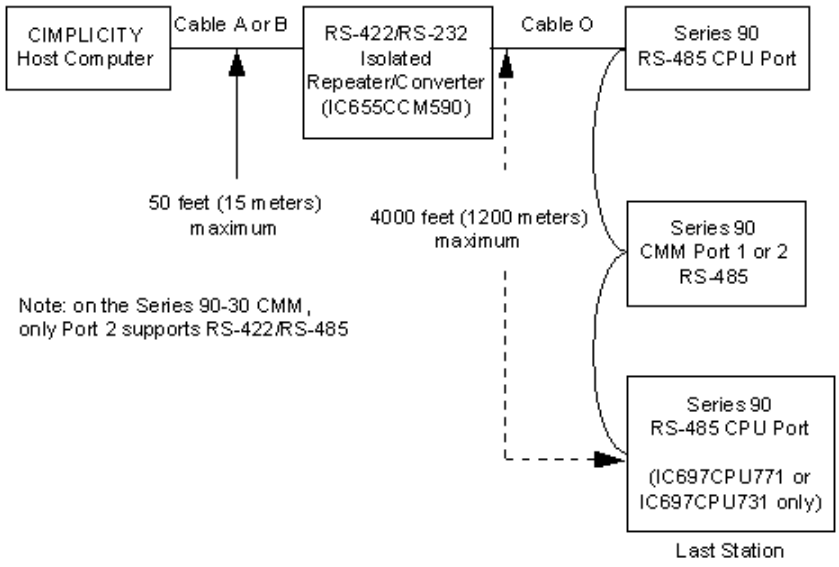
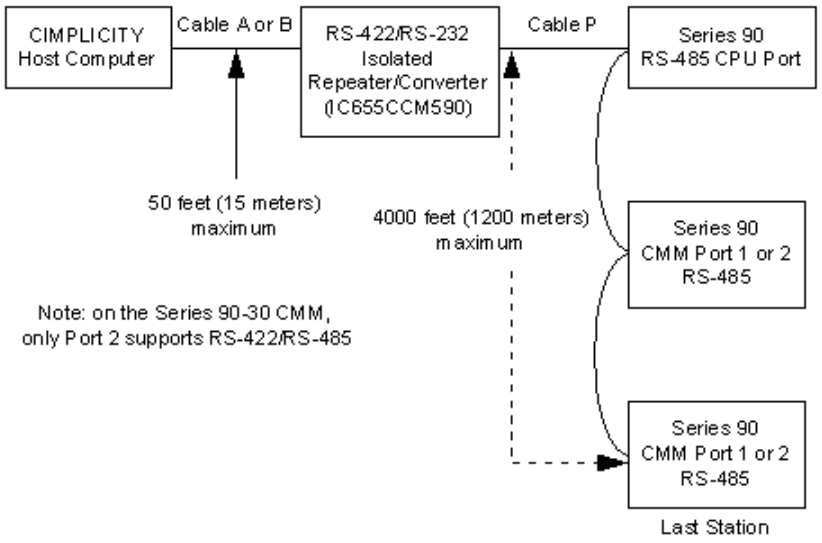

CIMPLICITY Host Computer
Cable A or B
RS-422/RS-232 Isolated Repeater/Converter (IC655CCM590)
Cable O
Series 90 RS-485 CPU Port
50 feet (15 meters) maximum
4000 feet (1200 meters) maximum
Series 90 CMM Port 1 or 2 RS-485
Note: on the Series 90-30 CMM, only Port 2 supports RS-422/RS-485
Series 90 RS-485 CPU Port
(IC697CPU771 or IC697CPU731 only)
Last Station

Diagram N

RS-422/RS-232 Isolated Repeater/Converter to Series 90 PLC Ports Multidrop Configuration

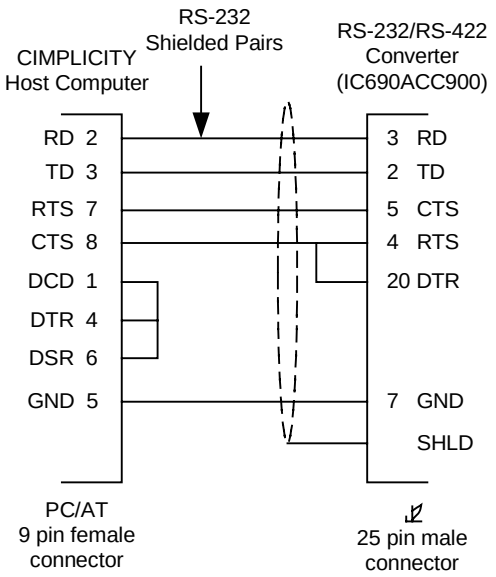

CIMPLICITY Host Computer
Cable A or B
RS-422/RS-232 Isolated Repeater/Converter (IC655CCM590)
Cable P
Series 90 RS-485 CPU Port
50 feet (15 meters) maximum
4000 feet (1200 meters) maximum
Series 90 CMM Port 1 or 2 RS-485
Note: on the Series 90-30 CMM, only Port 2 supports RS-422/RS-485
Series 90 CMM Port 1 or 2 RS-485
Last Station

Cable Configurations

The following drawings detail the cable configuration for the cables in the diagrams.

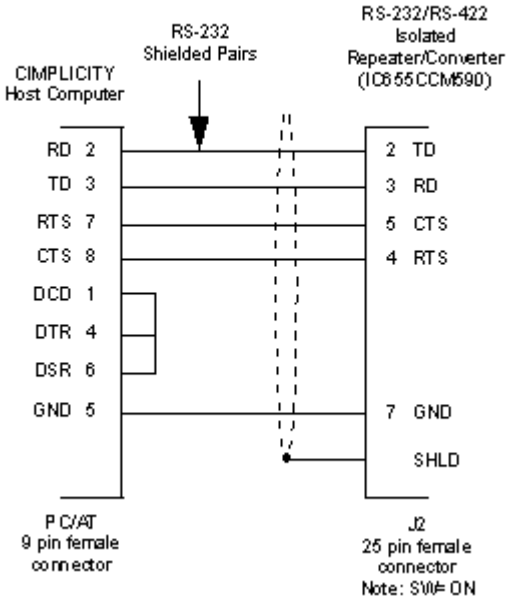
Cable A

PC/AT to RS-232 Converter



Cable B

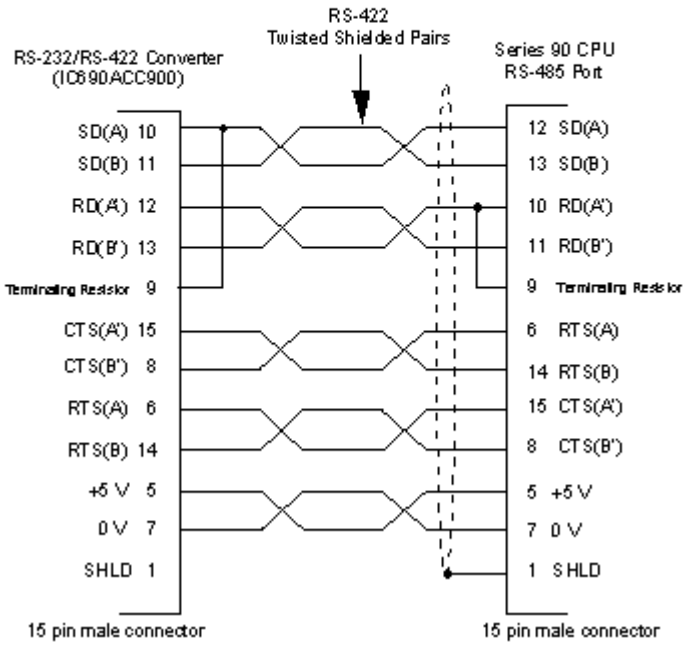
PC/AT to RS-422/RS-232 Isolated Repeater/Converter



Cable C

RS-232/RS-422 Converter to Series 90 CPU Port
Point-to-Point Configuration

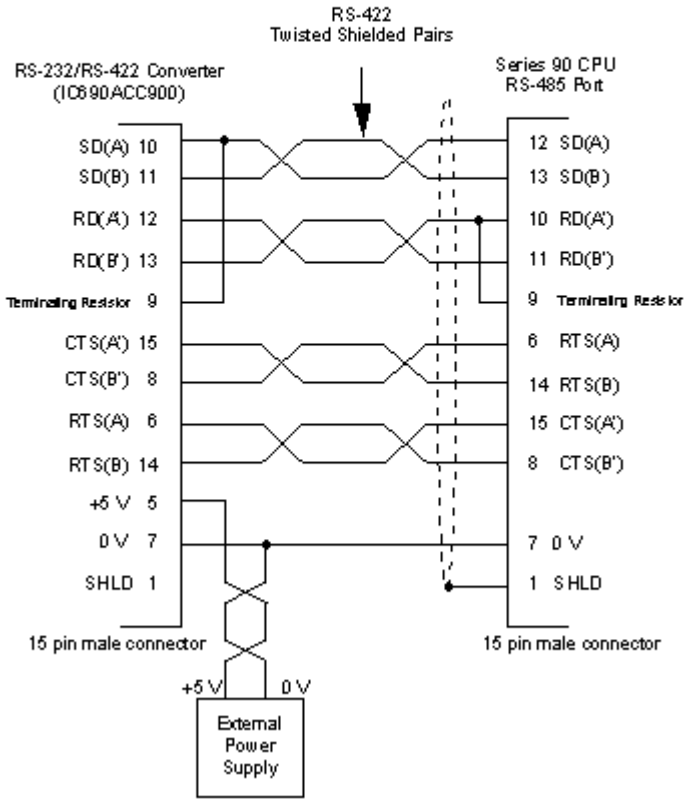
For all Series 90s, except the following Series 90-70s:
Catalog Number IC697 CPU771
Catalog Number IC697 CPU731



Cable D

RS-232/RS-422 Converter to Series 90 CPU Port
Point-to-Point Configuration

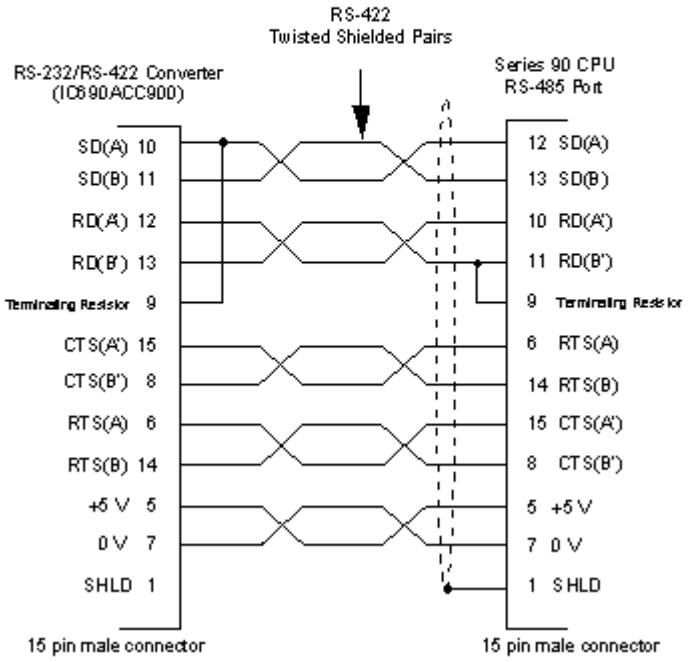
For all Series 90s, except the following Series 90-70s:
Catalog Number IC697CPU771
Catalog Number IC697CPU731



Cable E

RS-232/RS-422 Converter to Series 90 CPU Port Point-to-Point Configuration

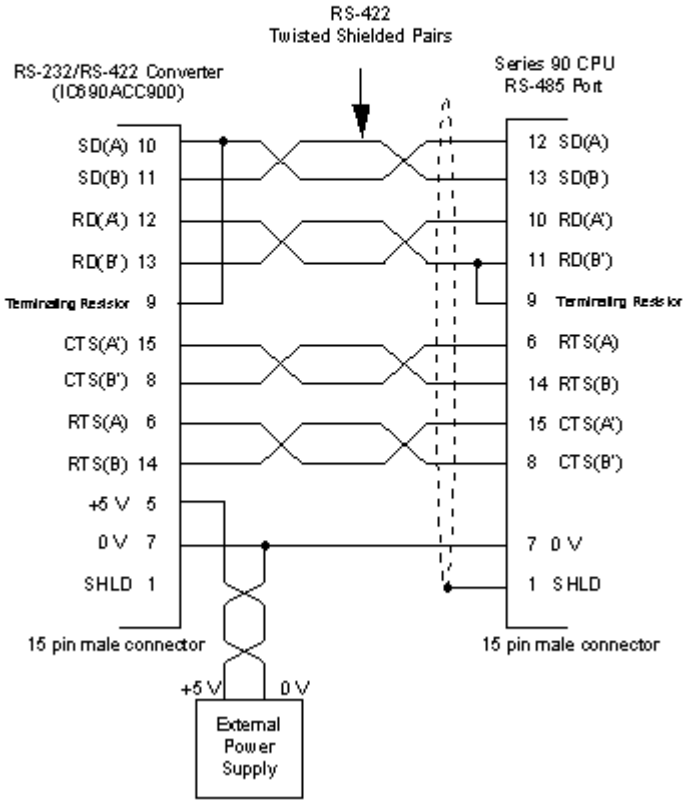
For the following Series 90-70s only:
Catalog Number IC697CPU771
Catalog Number IC697CPU731



Cable F

RS-232/RS-422 Converter to Series 90 CPU Port Point-to-Point Configuration

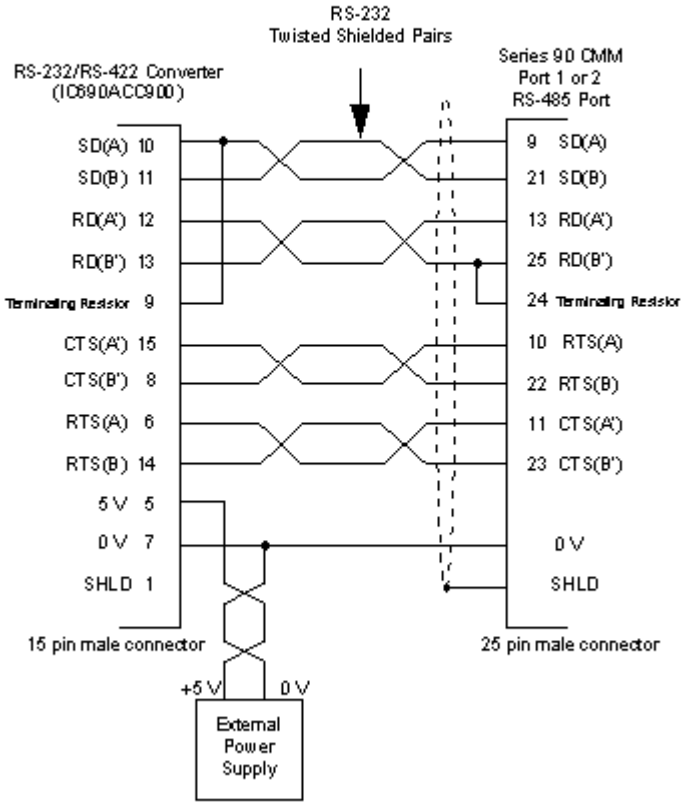
For the following Series 90-70s only:
Catalog Number IC697CPU771
Catalog Number IC697CPU731



Cable G

RS-232/RS-422 Converter to Series 90 CMM Point-to-Point Configuration

For the following Series 90-70s only:
Catalog Number IC697CPU771
Catalog Number IC697CPU731

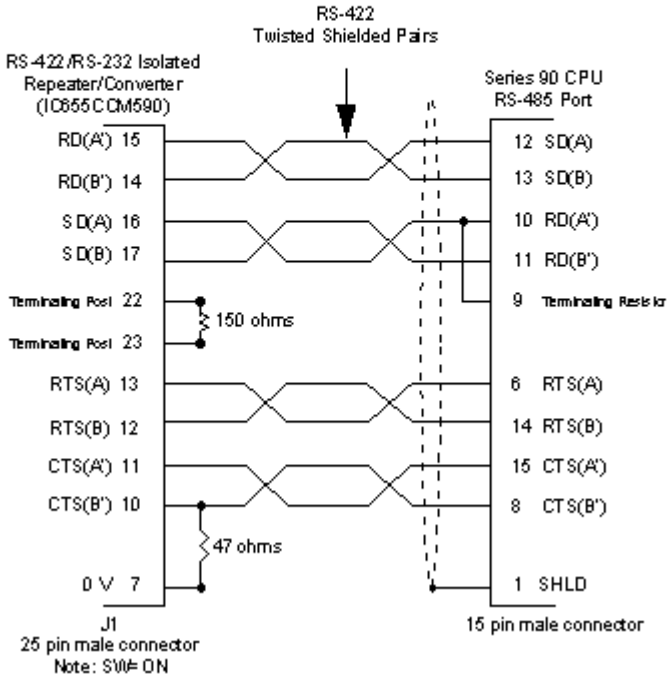


Note: On the Series 90-30 CMM, only Port 2 supports RS-422/RS-485

Cable H

RS-422/RS-232 Isolated Repeater/Converter to Series 90 CPU Port Point-to-Point Configuration

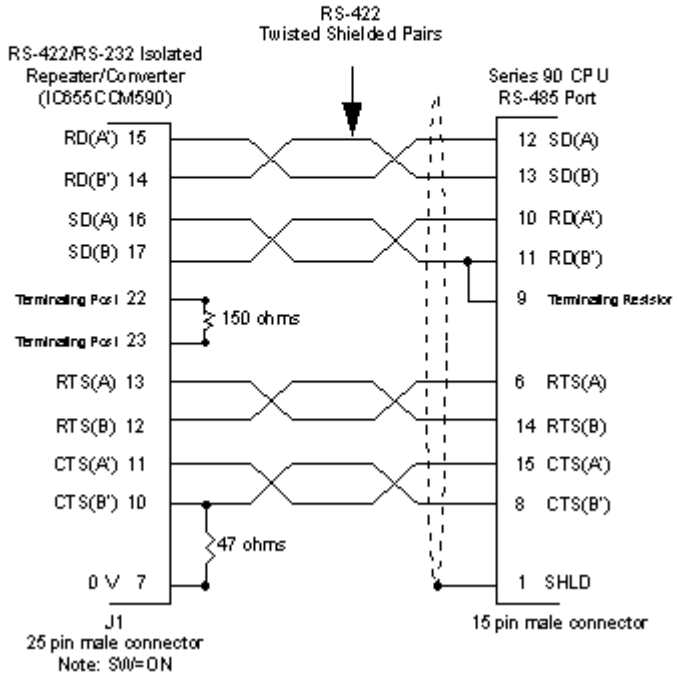
For all Series 90s, except the following Series 90-70s:
Catalog Number IC697CPU771
Catalog Number IC697CPU731



Cable I

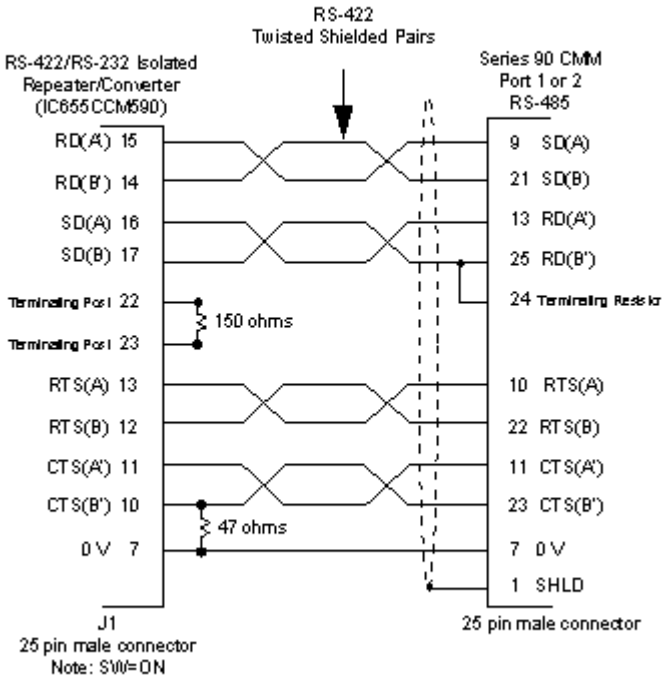
RS-422/RS-232 Isolated Repeater/Converter to Series 90 CPU Port Point-to-Point Configuration

For the following Series 90-70s only:
Catalog Number IC697CPU771
Catalog Number IC697CPU731



Cable J

RS-422/RS-232 Isolated Repeater/Converter to CMM Port Point-to-Point Configuration

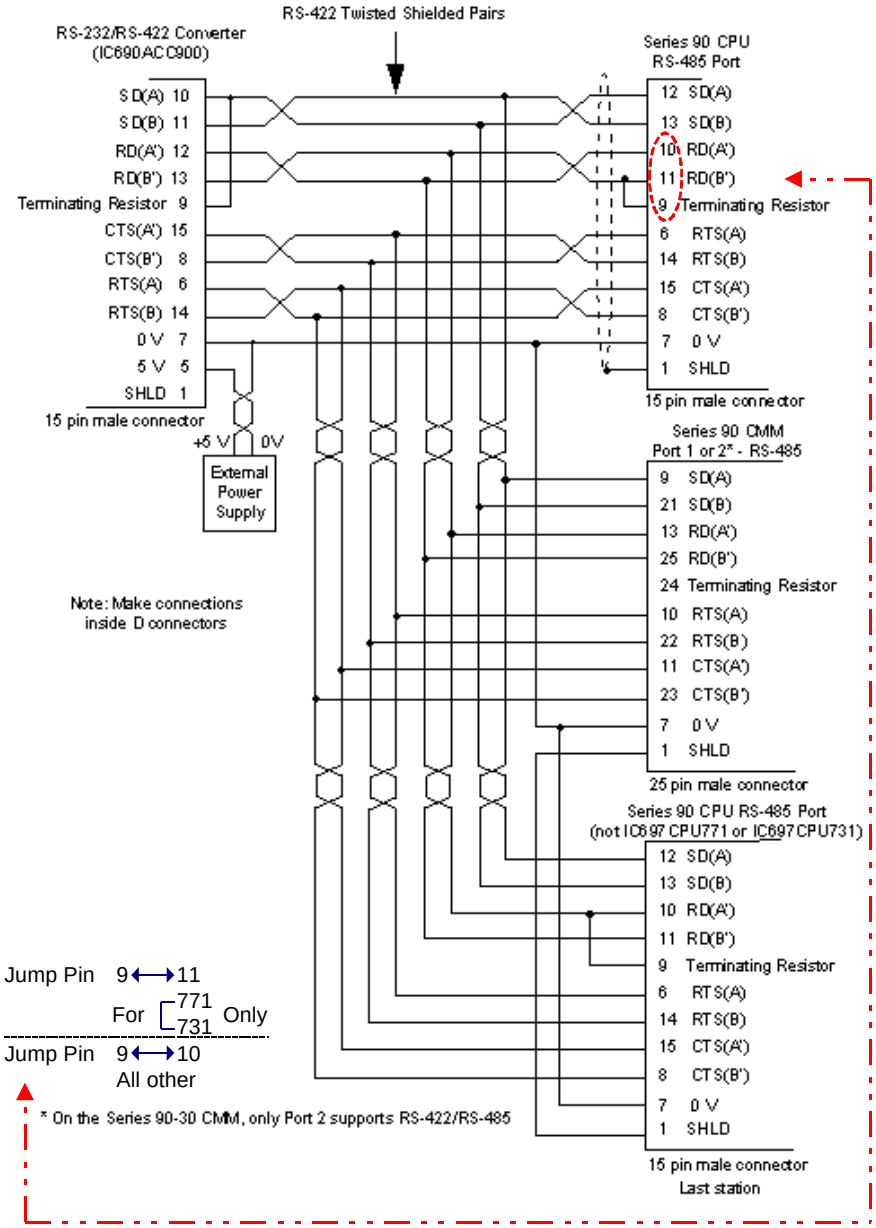


Note: on the Series 90-30 CMM, only Port 2 supports RS-422/RS-485

Cable K

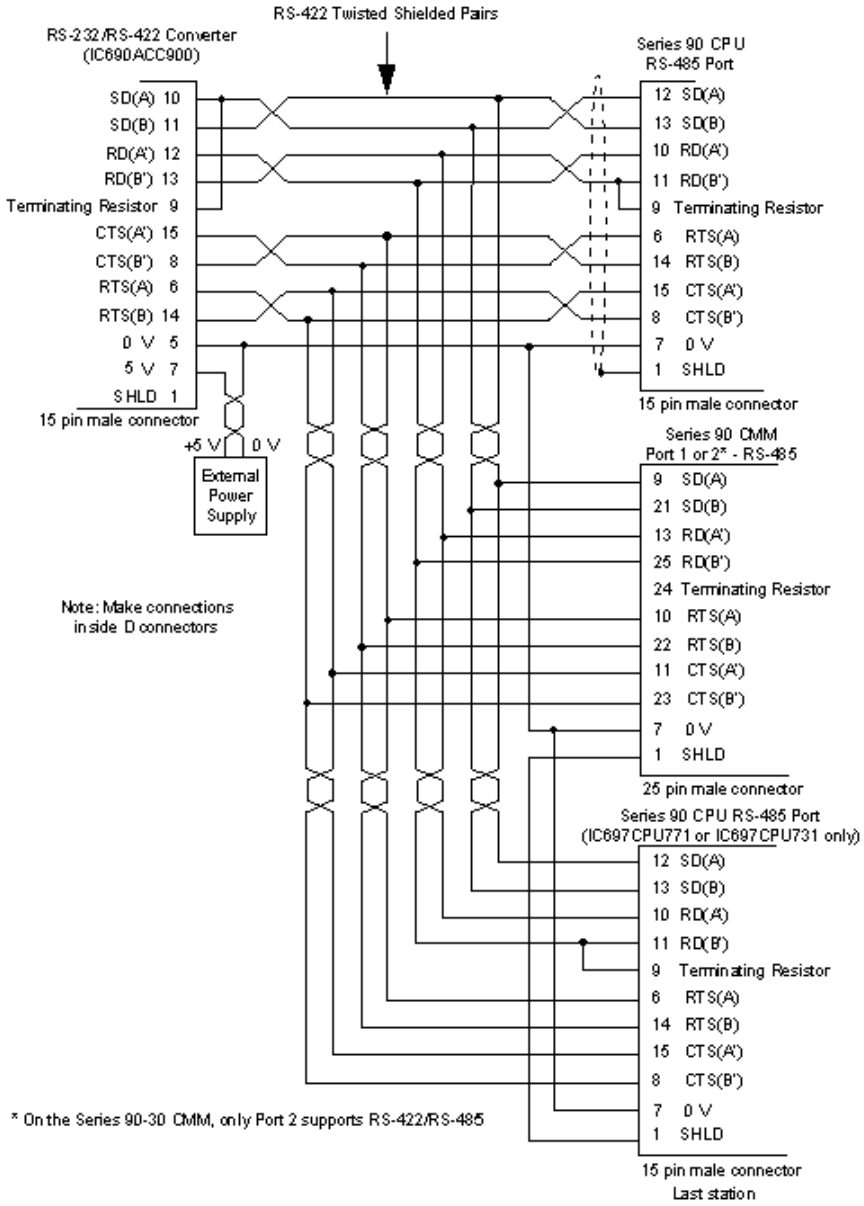
RS-422/RS-232 Converter to Series 90 CPU Ports
Multidrop Configuration

For the following Series 90-70s only:
Catalog Number IC697CPU771
Catalog Number IC697CPU731



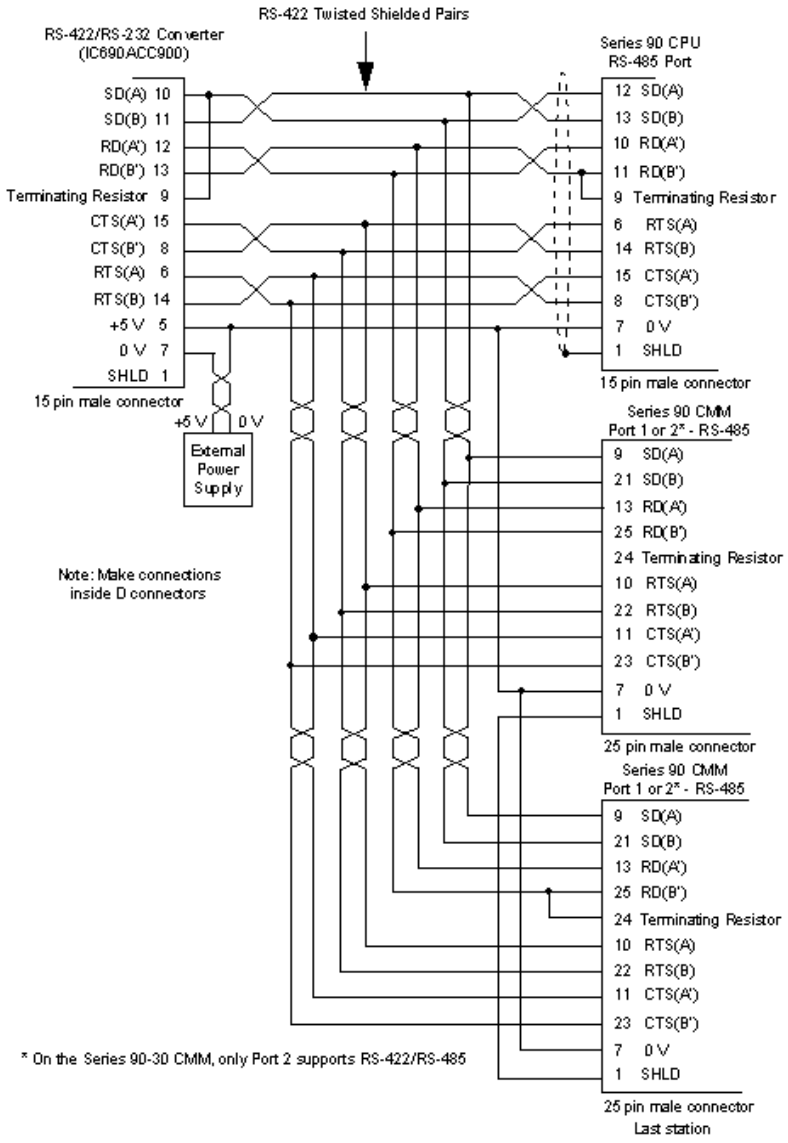
Cable L

RS-422/RS-232 Converter to Series 90 CPU Ports
Multidrop Configuration



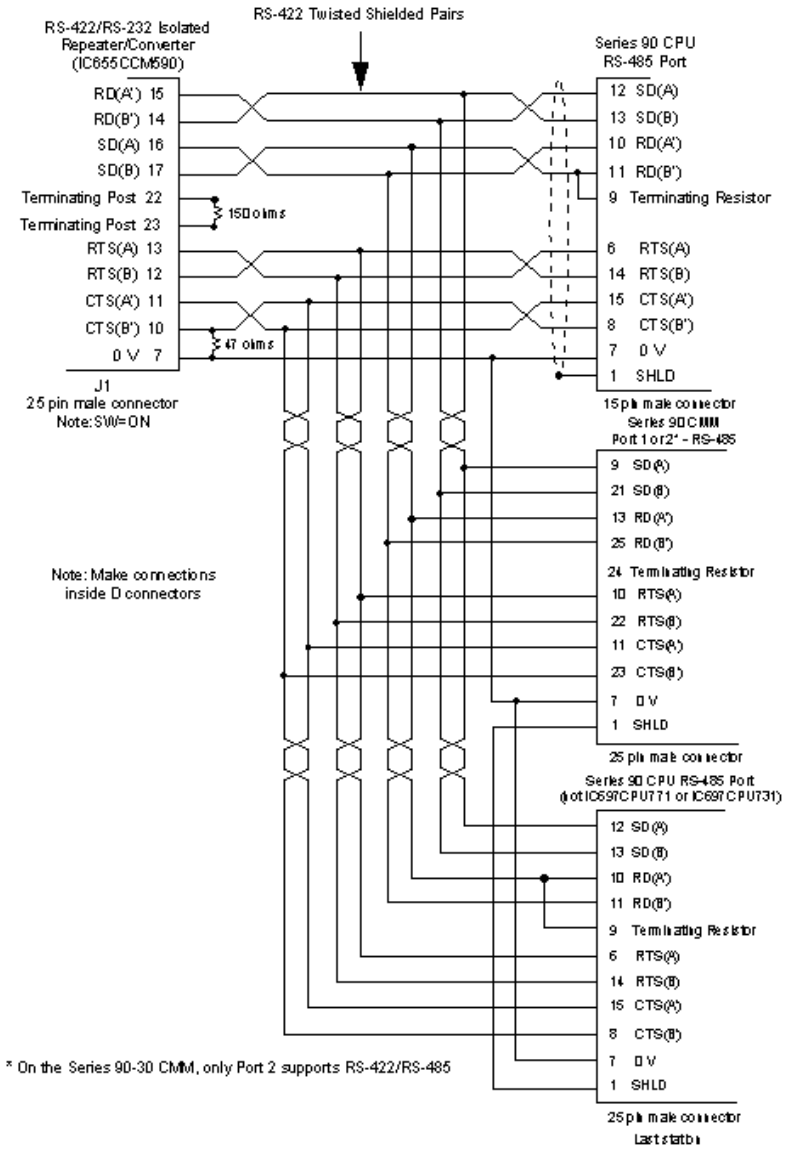
Cable M

RS-422/RS-232 Converter to Series 90 CPU Ports
Multidrop Configuration



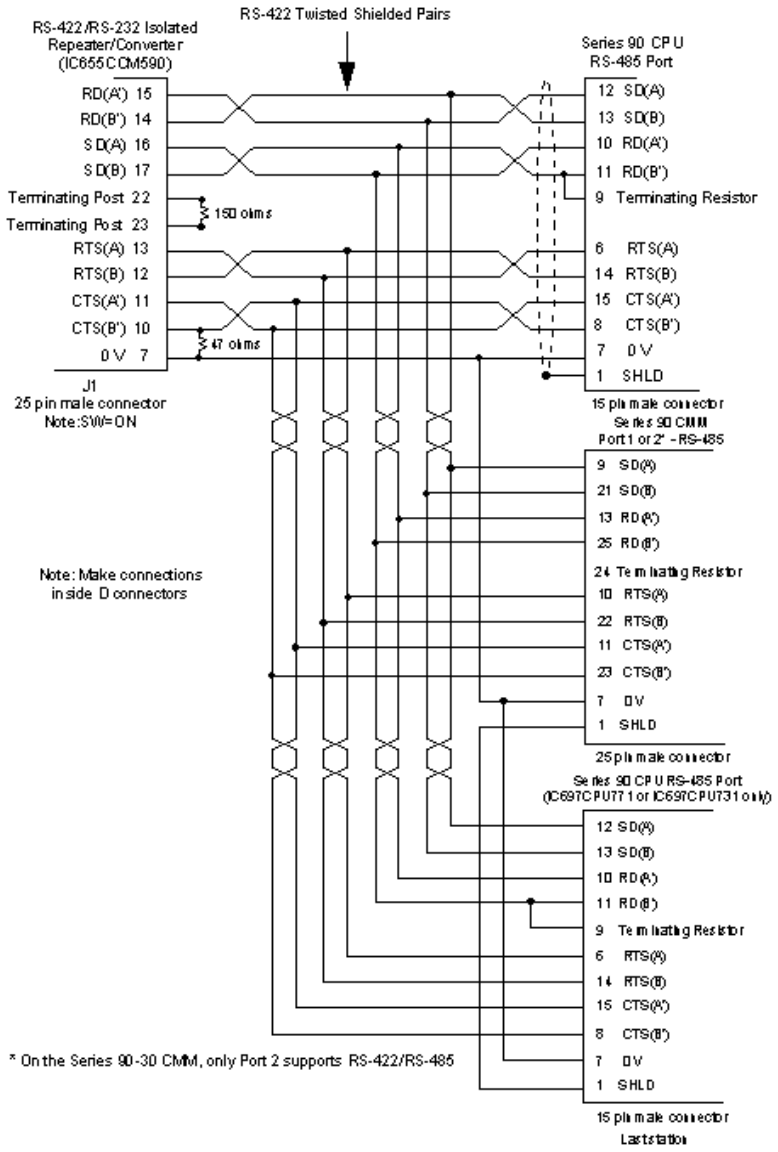
Cable N

RS-422/RS-232 Isolated Repeater/Converter to Series 90 Ports
Multidrop Configuration



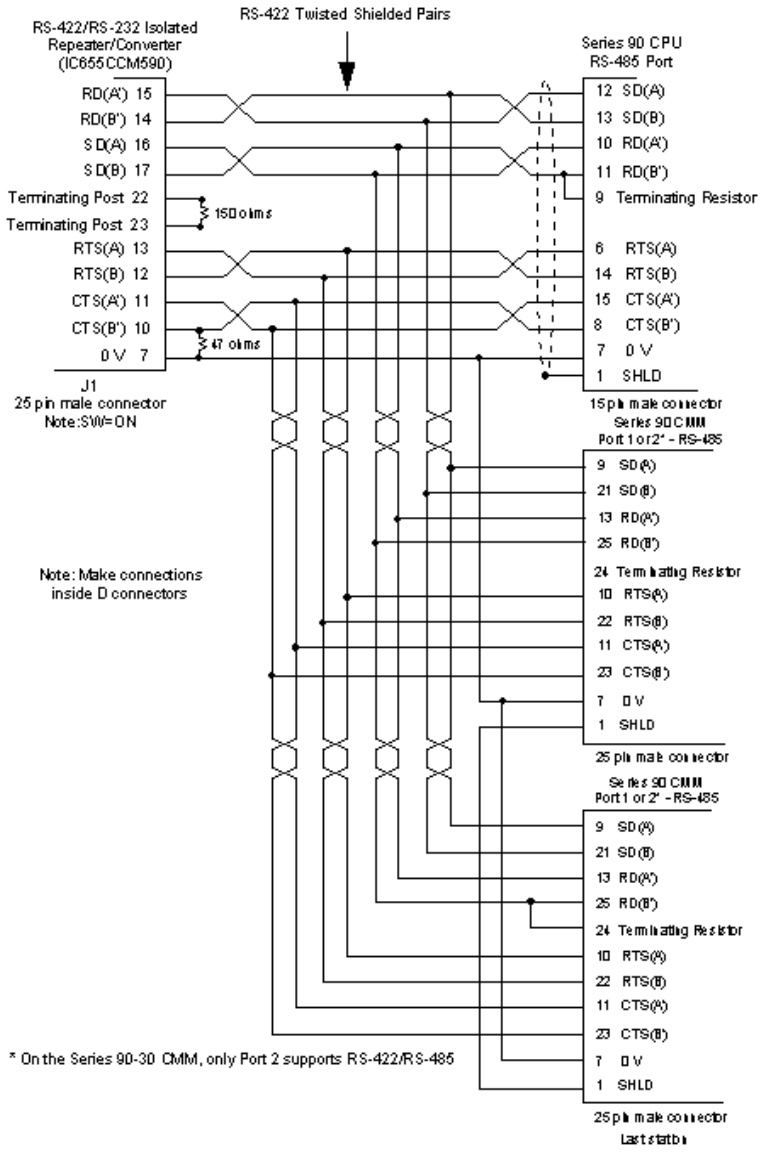
Cable O

RS-422/RS-232 Isolated Repeater/Converter to Series 90 Ports
Multidrop Configuration



Cable P

RS-422/RS-232 Isolated Repeater/Converter to Series 90 Ports
Multidrop Configuration



SNP and SNPX Hardware Installation

Serial communication ports are used to communicate between the Series 90 controllers and CIMPLICITY software. You may use standard serial ports on your PC.

If you are using SNP or SNPX communications with a Series 90-30, the ground connection at the PC COM port has to be removed for communications to work.

SNP and SNPX Application Configuration

When you are configuring ports, devices, and device points, you will be asked for some information that is specific to SNP or SNPX device communications

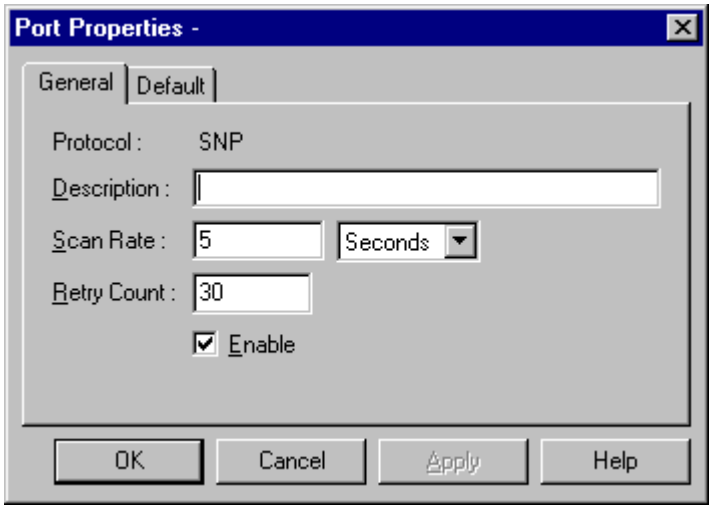
SNP and SNPX Port Configuration

When you create a new port for SNP or SNPX Communications, enter the following information in the *New Port* dialog:

1. In the **Protocol** field, select **SNP** or **SNPX** (as appropriate) from the list of protocols available.
2. In the **Port** field, select the communication port that will be used for SNP communications

When you click **OK** to create the port, the Port Properties dialog opens.

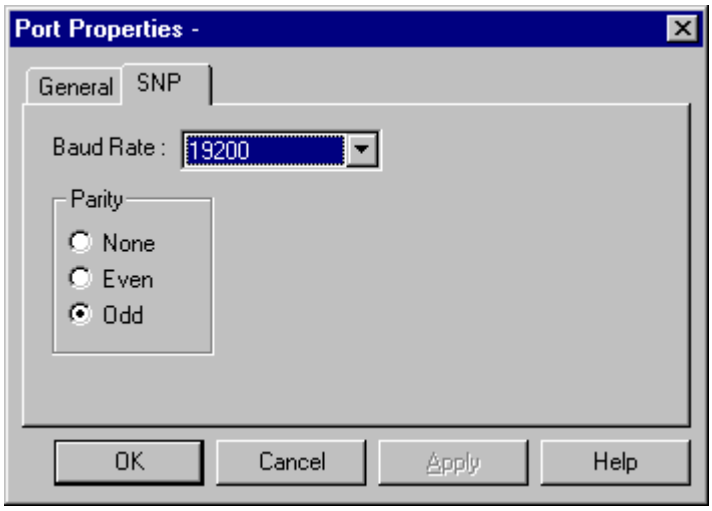
General Port Properties



Use the *General* properties to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be in multiples of the base rate. You can specify a scan rate in Ticks (100 ticks = 1 second), Seconds, Minutes, or Hours.
Retry Count	If communications cannot be established to a device on the port, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it. Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected. Configure the Retry Count to 3 or less under the following circumstances: For a Series 90-70 with a CPU firmware version prior to V4.02. For a Series 90-30 with a CPU firmware version prior to V3.03. For a Series 90-20.
Enable	Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

SNP Port Properties



Use the *SNP* properties to enter information about the SNP communications for the port. You can define the following:

Baud Rate	Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.
Parity	Select the parity for communications.

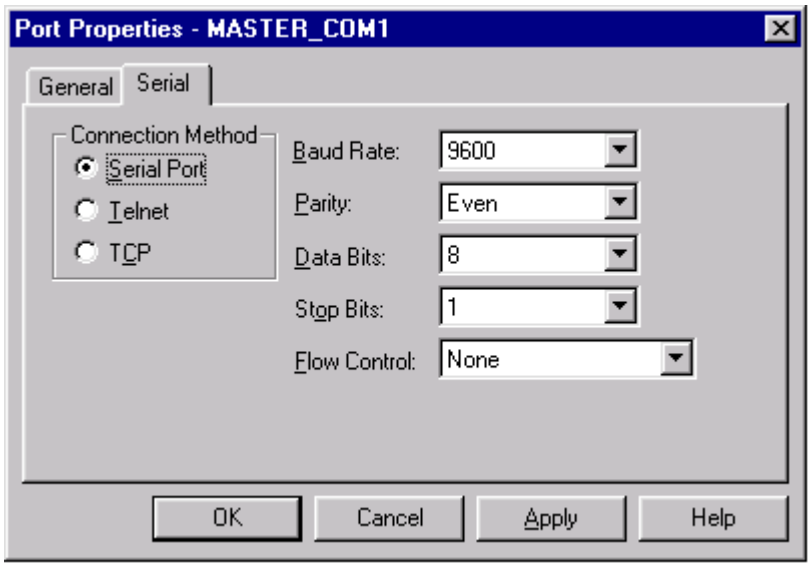
The default values are:

Baud Rate	19200
Parity	Odd

Series 90 controllers are normally shipped with the RS-485 and CMM ports configured for a baud rate of 19.2 Kbaud and odd parity.

Make sure the baud rate and parity you select match those on the Series 90s with which you are communicating.

Serial Port Properties for SNPX



If you select the serial port connection method, you need to define the following:

Baud Rate	Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.
Data Bits	Select the number of data bits per word to be used for communications.
Parity	Select the parity to be used for communications.
Stop Bits	Select the number of stop bits to be used for communications
Flow Control	Select the type of flow control to be used for communications.

The default values are:

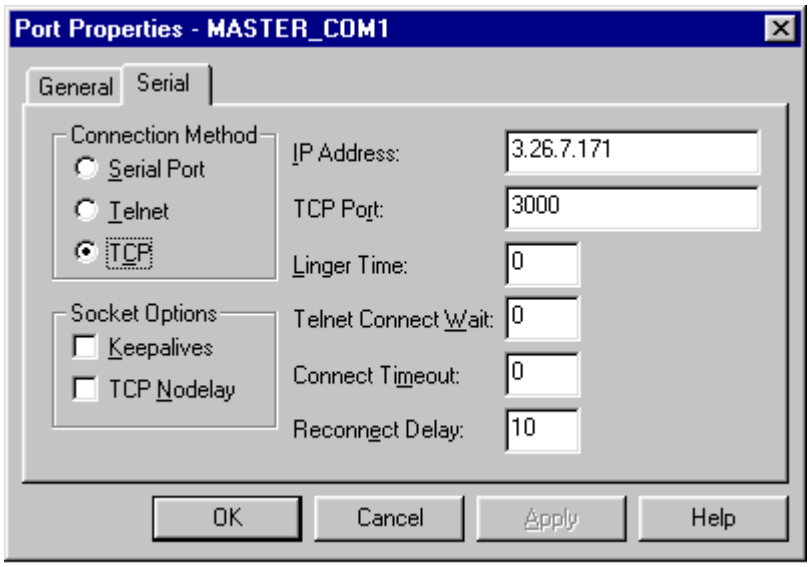
Baud Rate	19200
Data Bits	8
Parity	Odd
Stop Bits	1
Flow Control	None

Series 90 controllers are normally shipped with the RS-485 and CMM ports configured for a baud rate of 19.2 Kbaud and odd parity.

Make sure the configuration you select matches the configuration on the Series 90s with which you are communicating.

Remember that you must configure the same baud rate, data bits, parity, stop bits and flow control for all PLCs using the serial port.

Telnet or TCP Connection Port Properties for SNPX



If you select the Telnet or TCP connection method, you need to define the following:

Socket Options	Set the Keepalives check box to use keepalives to detect the loss of the terminal server. Clear the check box if you do not want to use keepalives to detect the loss of the terminal server.
	Set the TCP Nodelay check box if you want to set the Nodelay flag on the socket. Clear the check box if you do not want to set the Nodelay flag.
IP Address	Enter the IP address of the terminal server.
TCP Port	Enter the port number of the TCP port on the terminal server.
Linger Time	Enter the time in seconds to wait after closing the socket before aborting the socket.
Telnet Connect Wait	Enter the time in seconds to wait for the Telnet protocol to initialize.
Connect Timeout	Enter the time in seconds to wait for the TCP connection to form.
Reconnect Delay	Enter the time in seconds to wait before attempting to reconnect to a device.
	If you set this value to zero and the terminal server is not available, then no attempts will be made to reconnect to the terminal server.

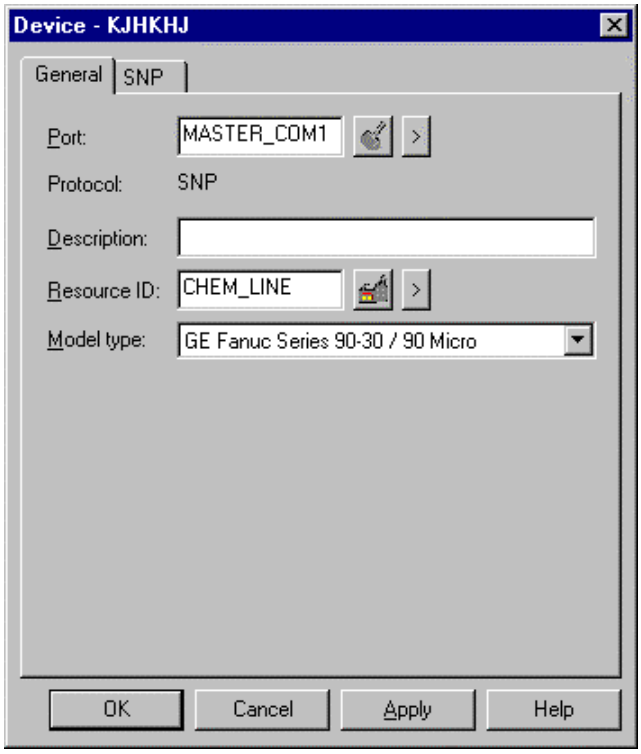
SNP and SNPX Device Configuration

When you create a new device for SNP or SNPX Communications, enter the following information in the *New Device* dialog:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the SNP port to be used by the device.

When you select **OK** to create the port, the *Device Properties* dialog box opens.

SNP/SNPX General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port Select the port for this device.

- Click the Browser button to the right of the field to display the list of ports and select one.
- Click the Pop-up Menu button to create a new port, edit the current port, or select a port from the list of ports.

Description — Enter an optional description to help you identify the device.

Resource — Enter a resource that can be associated with this device for alarm generation.

- Click the Browser button to the right of the field to display the list of resources and select one.
- Click the Pop-up Menu button to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type — Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection.

For SNP communications, the choices are:

GE Fanuc Series 90-30

GE Fanuc Series 90-70

GE Fanuc Series 90 Micro

For SNPX communications, the choices are:

Series 90-30 CPU 301

Series 90-30 CPU 311 10 slot

Series 90-30 CPU 311 5 slot

Series 90-30 CPU 313

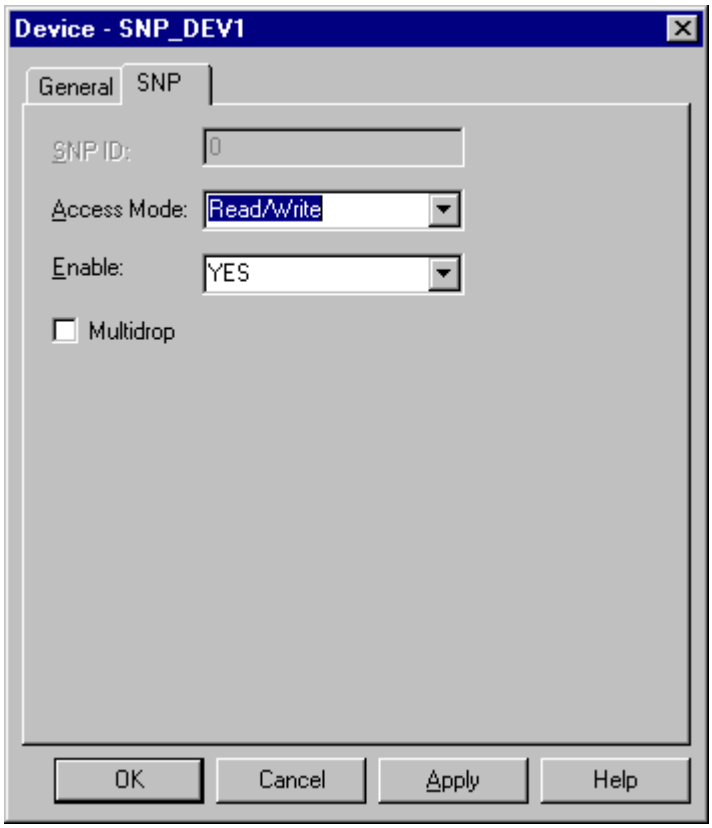
Series 90-30 CPU 323

Series 90-30 CPU 331

Series 90-30 CPU 341

Series 90-30 CPU 351

SNP/SNPX Device Properties



Use the SNP tab in the Device dialog box to enter information about SNP or SNPX device communications for the device. You can define the following:

SNP ID

For multidrop communications:

- Set the **Multidrop** check box.
- Enter the ID of the programmable controller in **SNP ID**.

The **SNP ID** may contain ASCII (A-Z) characters as well as numbers (0-9).

Access Mode

For point-to-point communications:

- Clear the Multidrop check box.
- Select Read or Read/Write in Access Mode.

Enable

For all communications

- Click **Yes** to enable the device when the project starts.
- Click **No** to disable the device. The points associated with the device will be unavailable.

SNP and SNPX Point Configuration

When you define a point, the following fields on the Device tab in the Point Properties dialog box, the point has values that are unique to or have special meanings for SNP and SNPX device communications:

Access	A point may be configured for READ or WRITE access.
Update Criteria	The update criteria determine how the data will be requested.
	Enter **On Change** or **On Scan** for points whose values should be polled by the SNP or SNPX communications enabler at regular intervals.
	Enter **On Demand On Change** or **On Demand On Scan** for points whose values should be polled by the SNP or SNPX communications enabler at regular intervals while users are viewing them.
	Enter **Poll Once** for points that are to be polled once when the SNP or SNPX communications enabler starts.
Address	Point address requirements are device-dependent. For SNP and SNPX device communications, the address format is
	<memory_type><offset>
	The memory types you can use are listed in the *Supported SNP and SNPX Memory Types* section

When you are configuring Boolean points, you must also enter data in the following fields:

Address Offset	Enter the bit offset that corresponds to the bit position within the word.

SNP Performance Notes

Impact on Series 90 Performance

When the attached port of a Series 90 controller is being used to support serial communications, a maximum of 5 milliseconds will be added to the scan on the controller. This should be taken into account in any application.

Performance Using the SNP Communications Enabler

The CIMPLICITY HMI SNP communications enabler is a serial communications enabler that supports access to most memory types in a Series 90 controller. The amount of data that can be transferred between CIMPLICITY HMI software and the Series 90 controller is limited by the baud rate and some protocol level tunables (discussed in the next section).

In addition, when communicating to multiple Series 90 controllers in a multidrop configuration, certain transactions between the CIMPLICITY HMI software and the Series 90 controller must occur each time communication is switched to a different Series 90 controller. These transactions occupy a significant amount of time (typically 0.4 to 1 seconds). When designing a CIMPLICITY HMI application, the throughput via SNP should be taken into account.

Tuning SNP Protocol Throughput

The protocol supports the ability to tune certain protocol level parameters that significantly impact performance. These parameters, along with the baud rate, are dominant factors in polling throughput.

SNP Data Size

This parameter controls the amount of data that can be sent between the host and the Series 90 controller. For CIMPLICITY HMI projects, CIMPLICITY software will attempt to negotiate a data size of 4000 bytes. This value was selected in order to optimize the I/O performance in the computer where CIMPLICITY HMI software is running. If a lower value is configured on the Series 90 controller, the lower value will be used.

Time between SNP Messages

This parameter controls the time between SNP messages. By default, CIMPLICITY HMI software attempts to negotiate a value of 5 milliseconds. You can configure a higher value by defining a logical named BSM$SNP_T1_TIME.

To define this logical, add a line to the project's **`data\log_names.cfg`** file with the following format:

```
BSM$SNP_T1_TIME|S|default|3|<time>
```

where **`<time>`** is the desired time in milliseconds between messages.

If you create or modify the logical, you must stop and restart the project for the new value to take effect.

As with the data size parameter, the time between SNP messages is a negotiated value. A higher value on the Series 90 controller will result in the higher value being used.

Time before SNP Attach Messages

This parameter controls the time delay before SNP attach messages. By default, there is a 1 millisecond delay before the SNP attach messages. If the SNP attach fails while the PLCs are running, a minimum value of 5 milliseconds is recommended to resolve the connect failure situation. You can configure a longer delay value by defining a logical named BSM$SNP_ATTACH_DELAY.

To define this logical, add a line to the project's **`data\log_names.cfg`** file with the following format:

```
BSM$SNP_ATTACH_DELAY|P|default|3|<time>
```

where **`<time>`** is the desired delay time in milliseconds before the SNP attach messages.

If you create or modify the logical, you must stop and restart the project for the new value to take effect.

SNP Special Notes

Logging Controller Information

When a CIMPLICITY HMI project first establishes communication with a Series 90 controller, it prints out the Series 90 controller's model, SNP timer values, the internal data transfer size and the number of elements for each memory type available in CIMPLICITY software. This information appears in the **`<PORT>.out`** file in the project's **`log`** directory, where **`<PORT>`** is the name of the port configured for SNP communications. For example, if SNP is configured to run on COM1, the output file will be **`COM01.out`**.

Enabling Protocol Level Debugging

In addition to this information, the SNP communications enabler supports the ability to dynamically enable/disable the logging of protocol level errors as they occur. This information is logged in the Status Log file. By default, the logging of protocol level errors is disabled. When difficulties are encountered in communicating with a device, it may be useful to enable the protocol level debugging. To do this, create the **`<PORT>.debug`** file in the project's **`\log`** directory, where **`<PORT>`** is the name of the port configured for SNP communications.

To create the file, select **Command Prompt...** from your project's **Tools** menu, then type the following commands to create the file:

```
cd .\log
copy nul <PORT>.debug
```

where **`<PORT>`** is the name of the port configured for SNP communications. For example, if SNP is configured to run on COM1, the file name will be **`COM01.debug`**.

The debugging begins immediately. You do not need to restart the CIMPLICITY HMI project.

Disabling Protocol Level Debugging

To turn off the logging of protocol level information, remove the **`COM01.debug`** file from the project's **`\log`** directory.

To remove the file, select **Command Prompt...** from your project's **Tools** menu, then type the following commands to create the file:

```
cd .\log
del <PORT>.debug
```

where **`<PORT>`** is the name of the port configured for SNP communications.

SNPX Performance Notes

Time after SNPX Broadcast Attach Messages

This parameter controls the time delay after SNPX broadcast attach messages. By default, there is a 20 millisecond delay after the SNPX broadcast attach messages. If the SNPX fails to read data from PLCs while the PLCs are running, a longer delay is recommended to resolve the read request failure situation. You can configure a longer delay value by defining a logical named SNPX_ BROADCAST_TIME.

To define this logical, add a line to the project's **`data\log_names.cfg`** file with the following format:

```
SNPX_BROADCAST_TIME|P|default|10|<time>
```

where **`<time>`** is the desired delay time in milliseconds after the SNP-X broadcast attach messages.

If you create or modify the logical, you must stop and restart the project for the new value to take effect. Please refer to Series 90 PLC Serial Communications User's Manual for more information regarding this broadcast delay timer.

Square D SY/MAX Communications

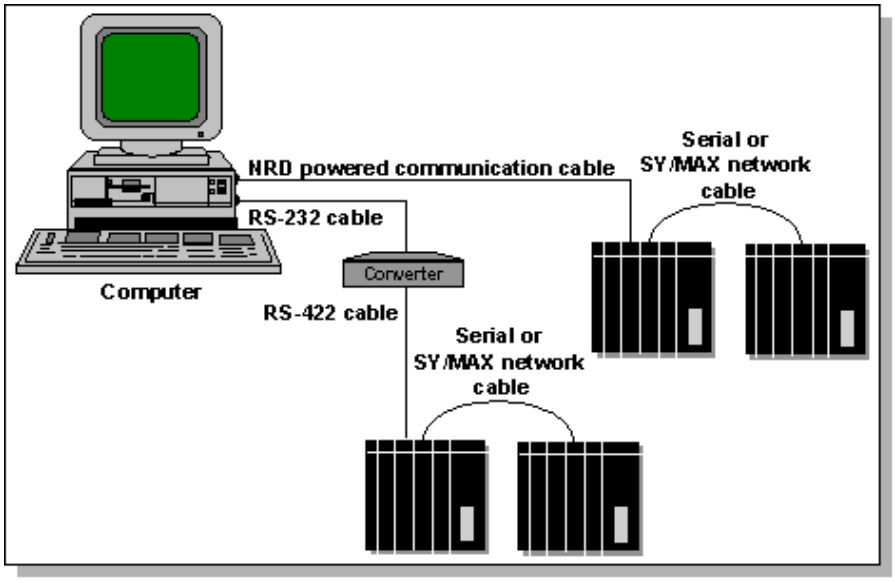
About Square D SY/MAX Communications

The Square D SY/MAX Communications option lets you exchange data between CIMPLICITY HMI software and Square D family PLCs using Square D's SY/MAX protocol.

Communications between a CIMPLICITY HMI computer and Square D PLCs via SY/MAX protocol is accomplished by connecting a serial port on the CIMPLICITY HMI computer to a SY/NET Network Interface Module or the direct serial port on the first PLC in the network. Routing information, as defined in the *Processor Instruction Bulletin* for your PLC model(s), is used to route requests to the devices.

This protocol was validated using an NRD powered communication cable.

If you are using an RS-232 cable from the serial port on your computer, you will need an RS232 to RS422 converter box and an RS-422 cable to connect to the first PLC. The use of an isolated converter box is recommended.



You can connect up to 199 programmable controllers to a CIMPLICITY HMI computer on a single network connection. Networks can also be linked.

This enabler supports the following CIMPLICITY HMI features:

- Polled reads at user defined rates
- Triggered reads
- Unsolicited data
- Analog deadband
- Alarm on communications failure

This enabler supports the following data types:

- Signed 8, 16, and 32 bit integers
- Unsigned 8, 16, and 32 bit integers
- Floating point
- Text
- Arrays

Required Documents

You should have the following documentation, as it applies to your hardware configuration, available when configuring this interface:

Square D SY/MAX Protocol Reference Instruction Bulletin 30598-713-01

Square D SY/NET Network Interface Module Instruction Bulletin 30598-713-01

Square D SY/NET Network Interface Module Technical Overview TO-257-03

Square D SY/MAX Model 400 Processor Instruction Bulletin 30598-503-01

Square D SY/MAX Model 600 Processor Instruction Bulletin 30598-609-01

Supported Devices

The Square D SY/MAX Communication option supports data collection and modification of memory values in target devices that adhere to the protocol specified in the ***Square D SY/MAX Protocol Reference Instruction Bulletin 30598-713-01***. Devices supporting this protocol include:

- SY/MAX Model 600 Processor; Class 8020, Type SCP631, and 632
- SY/MAX Model 500 Processor; Class 8020, Type SCP501, 522, 523, and 544
- SY/MAX Model 400 Processor; Class 8020, Type SCP401, 423, 424, and 444
- SY/Matic Weld Controllers (EQ5200, EQ5110, EQ5100)
- Power Logic Circuit Monitor; Class 3020

Supported Memory Types

Square D does not reserve areas of user memory for special purposes or data types. Memory locations (registers) contain 16 bits and are addressed by their location numbers.

Installation Requirements

You may use any available serial communication port on your computer for Square D SY/MAX communications. No special port configuration is required.

About the Square D SY/MAX Test Program

A stand-alone test program, **`sd_test.exe`**, is provided. This program provides direct communication between CIMPLICITY HMI software and a SY/NET Network Interface Module, or between the CIMPLICITY HMI software and a Programmable Logic Controller.

The test program can be used to:

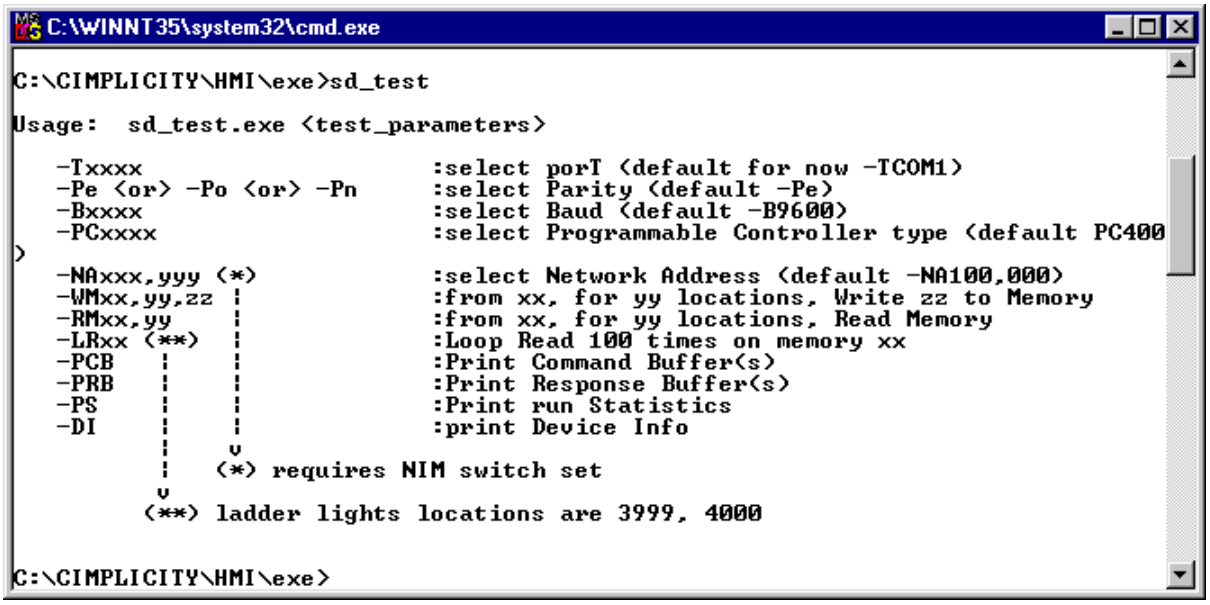
- Verify port, network, and interface unit communication parameters.
- Verify line, network, and hardware functionality and operability.
- Directly access (for reading or writing) a specific PLC register location.
- Dump or clear some or all of the PLC user registers.
- Examine the send and receive message buffer content.
- Collect transmission statistics of the current configuration.
- Verify device information response.

You *cannot* use the test program while the CIMPLICITY Square D Communications enabler is running.

If the protocol for Square D is copyrighted or declared to be trademark or proprietary, or there are very restrictive conditions on copying the manual, obtain written permission from Square D to display the command or response buffers in the test program.

The Test Program Banner Page

To display the test program banner page, enter the test program name, without any test parameters. The resulting display is as follows:


C:\WINNT35\system32\cmd.exe
C:\CIMPLICITY\HMI\exe>sd_test
Usage: sd_test.exe <test_parameters>
-Txxxx :select porT (default for now -TCOM1)
-Pe <or> -Po <or> -Pn :select Parity (default -Pe)
-Bxxxx :select Baud (default -B9600)
-PCxxxx :select Programmable Controller type (default PC400
)
-NAxxx,yyy (*) :select Network Address (default -NA100,000)
-WMxx,yy,zz :from xx, for yy locations, Write zz to Memory
-RMxx,yy :from xx, for yy locations, Read Memory
-LRxx (**) :Loop Read 100 times on memory xx
-PCB :Print Command Buffer(s)
-PRB :Print Response Buffer(s)
-PS :Print run Statistics
-DI :print Device Info
(*) requires NIM switch set
(**) ladder lights locations are 3999, 4000
C:\CIMPLICITY\HMI\exe>

Examples of Test Program Applications

Ensure that the port, parity, baud, PLC type, and network address are specified on the command line, if different that the default.

Examples

sd_test.exe -TCOM1 -B4800 -PC423

selects the COM1 port, sets the baud rate to 4800 and selects the 423 programmable controller type.

sd_test.exe -B2400 -NA100.077

sets the baud rate to 2400 and the network address to 100.077

Use the WM, RM, or LR commands to write or read to specified register (memory) locations.

Examples

sd_test.exe -RM1,8000

initiates a memory dump of a Series 600 PLC.

sd_test.exe -WM18,3981,0

writes zeroes in locations 18 through 3981 of a Series 400 PLC.

sd_test.exe -RM1011

reads memory location 1011 in the PLC.

sd_test.exe –LR3999

executes a loop and read 100 times on location 3999 in the PLC.

Use the PCB, PRB, and PS commands for additional diagnostic information.

Examples

sd_test.exe –PRB –PCB

prints the command and receive messages of specified operation

sd_test.exe – PS

prints statistics pertaining to the specified operation

Use DI to verify or ascertain PLC type and memory size recognition.

Example

sd_test.exe –PC500 –DI

prints the device information for a Series 500 PLC.

CIMPLICITY Application Configuration

As with other CIMPLICITY communication options, you must complete the Port, Device, and Device Point configuration to set up Square D SY/MAX device communications.

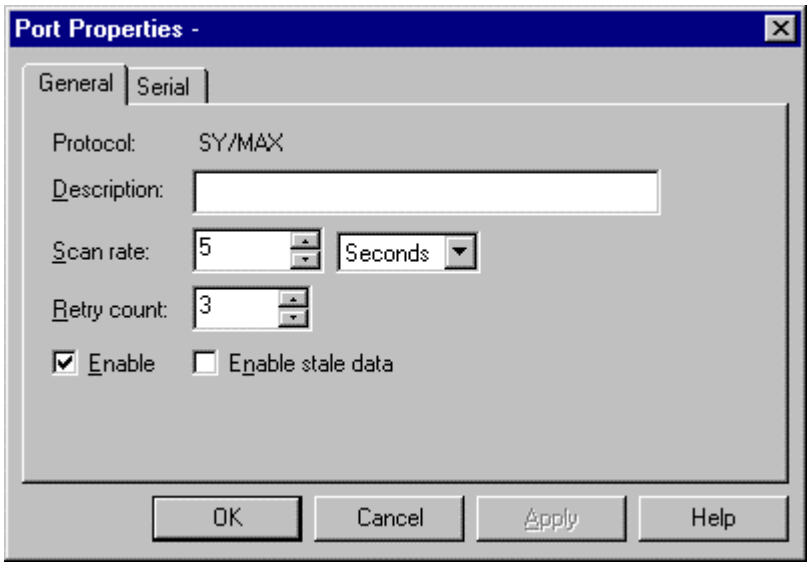
Port Configuration

When you create a new port for Square D communications, enter the following information in the *New Port* dialog box:

1. In the **Protocol** field, select **SY/MAX** from the list of available protocols.
2. In the **Port** field, select the communication port that will be used for Square D communications.

When you select **OK** to create the port, the *Port Properties* dialog box for the protocol opens.

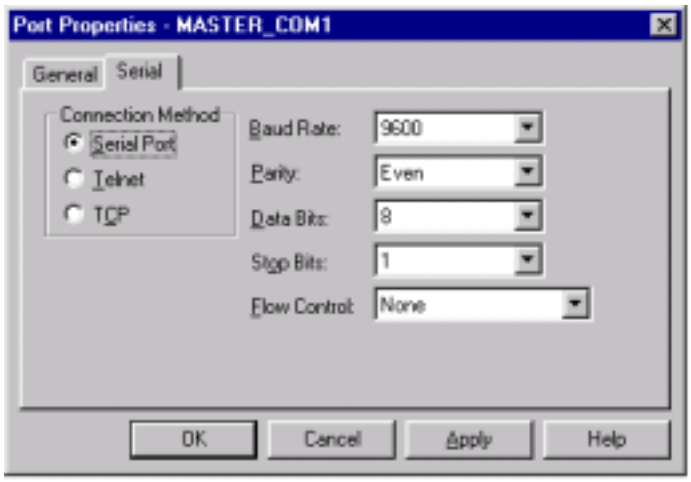
SY/MAX General Port Properties



Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify a scan rate in **Ticks** (100 ticks = 1 second), **Seconds**, **Minutes**, or **Hours**.
Retry Count	If communications cannot be established for a device on the port, the device is considered to be down, and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connections to it. Enter the number of scans to wait before attempting to reconnect to a device after a communications error has been detected.
Enable	Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Serial Port Properties: Serial Port Connection

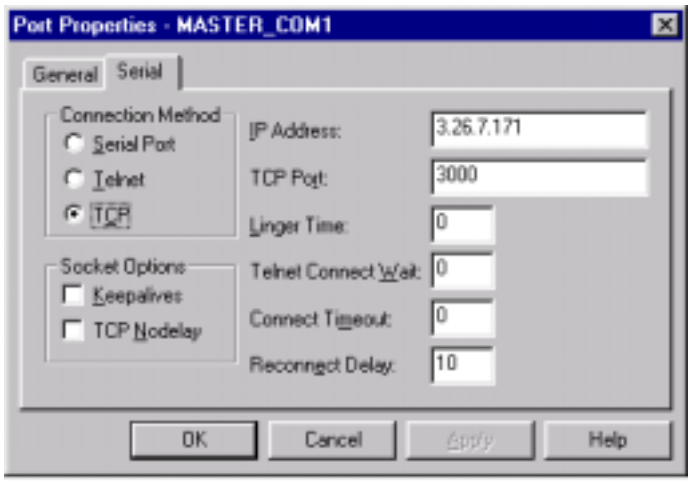


If you select the serial port connection method, you need to define the following:

Baud Rate	Enter the baud rate for communications. Click the drop-down list to the right of the input field and select a rate from the list.
Data Bits	Select the number of data bits per word to be used for communications.
Parity	Select the parity to be used for communications.
Stop Bits	Select the number of stop bits to be used for communications
Flow Control	Select the type of flow control to be used for communications. If you change the Flow Control type, you must reboot the PC for the changes to take affect.

Remember that you must configure the same baud rate, data bits, parity, stop bits and flow control for all PLCs using the serial port.

Serial Port Properties: Telnet or TCP Connection



If you select the Telnet or TCP connection method, you need to define the following:

Socket Options	Set the **Keepalives** check box to use keepalives to detect the loss of the terminal server. Clear the check box if you do not want to use keepalives to detect the loss of the terminal server. Set the **TCP Nodelay** check box if you want to set the Nodelay flag on the socket. Clear the check box if you do not want to set the Nodelay flag.
IP Address	Enter the IP address of the terminal server.
TCP Port	Enter the port number of the TCP port on the terminal server.
Linger Time	Enter the time in seconds to wait after closing the socket before aborting the socket.
Telnet Connect Wait	Enter the time in seconds to wait for the Telnet protocol to initialize.
Connect Timeout	Enter the time in seconds to wait for the TCP connection to form.
Reconnect Delay	Enter the time in seconds to wait before attempting to reconnect to a device. If you set this value to zero and the terminal server is not available, then no attempts will be made to reconnect to the terminal server.

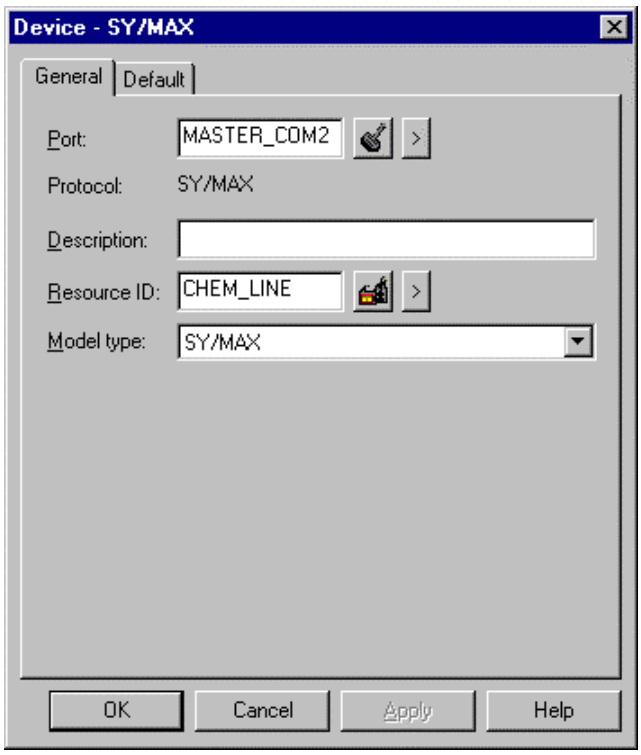
Device Configuration

When you create a new device for Square D SY/MAX communications, enter the following information in the New Device dialog box:

1. In the **Device** field, enter the name of the device you are configuring.
2. In the **Port** field, select the Square D SY/MAX port to be used by the device.

When you select **OK** to create the device, the Device Properties dialog box opens.

SY/MAX General Device Properties



Use the General tab in the Device dialog box to enter general information for the device. You can define the following:

Port — Select the port for this device.

- You can click the Browser button to the right of the field to display the list of ports and select one.
- You can click the Pop-up Menu button to create a new port, edit the current port, or select a port from the list of ports.

Description — Enter an optional description to help you identify the device.

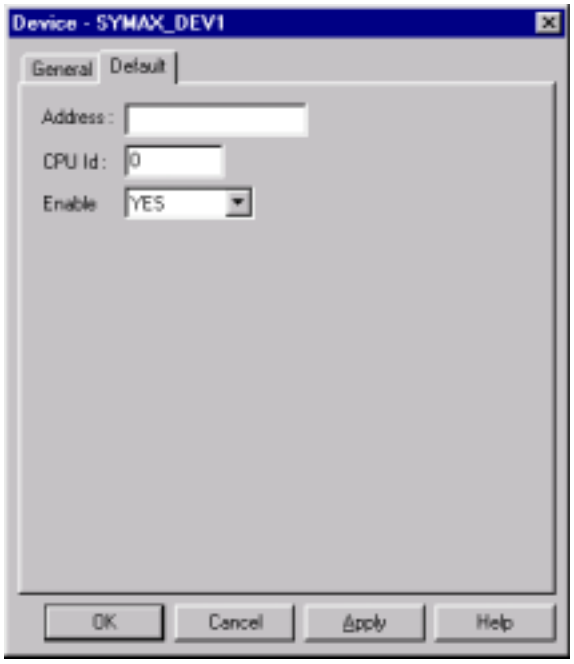
Resource Enter a resource that can be associated with this device for alarm generation.

- You can click the Browser button to the right of the field to display the list of resources and select one.
- You can click the Pop-up Menu button to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the only choice is:

SY/MAX	**SY/MAX-500**
SY/MAX-300	**SY/MAX-600**
SY/MAX-400	**SY/MAX-AS42C**

SY/MAX Default Device Properties



Use the Default tab in the Device dialog box to enter information about Square D SY/MAX communications for the device. You can define the following:

Address Each device to be accessed by the Square D SY/MAX Device Communications interface will require a sequence of one (1) or more 3-digit numbers representing the network route (for example, 100 101).

CPU ID Not used.

Enable Select Yes to enable the device when the project starts. If you select No, the device will not be enabled and points associated with the device will be unavailable.

Point Configuration

Once your devices are configured, you may configure data points for them. The fields described below have values that are unique or have specific meaning for Square D SY/MAX Device Communications.

SY/MAX General Point Properties

On the General tab in the Point Properties dialog box, you may configure points for **Read** or **Read/Write** access.

SY/MAX Device Point Properties

On the Device tab in the Point Properties dialog box:

Update Criteria

The update criteria you use determines how the data will be requested.

Select **On Change** or **On Scan** for points whose values should be polled by the SY/MAX driver at regular intervals.

Select **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by the SY/MAX driver at regular intervals while users are viewing them.

Address

A Square D SY/MAX address consists of a register (memory location) number. The ranges on the various models are:

300 Series PLC = 1-112

400 Series PLC = 1-4000

500 Series PLC = 1-4193

600 Series PLC = 1-8000

Generic SYMAX model = 1-4000

Addresses must be specified as numerical values within the PLC range. The FLOATING Point Type occupies two adjacent registers and must be specified as an odd number within the PLC range.

SY/MAX Advanced Configuration Topics

You can control some of the SY/MAX Communications options through global parameters. This section discusses those global parameters and their settings. *See the "Global Parameters" topic in the CIMPLICITY Base System User's Manual (GFK-1180) for details on setting global parameters.*

SYMAX_<port_name>_WORD_SWAP

By default, the SY/MAX Communications enabler swaps byes for digital word points.

To disable byte swapping, you can add the following to the global parameter file:

SYMAX_<port_name>_WORD_SWAP|1|NO

where <**port_name**> is the name of the SY/MAX port.

To enable byte swapping again, you can delete the global parameter, or change the parameter value from **NO** to **YES**.

Toyopuc Ethernet Device Communication Module

About Toyopuc Ethernet Device Communication Module

This communication enabler supports data collection from Toyoda Machine Work's Toyopuc PC2 Series programmable controllers via Ethernet. From an Ethernet connection established with a Toyopuc programmable controller, it is possible to collect data from the local programmable controller as well as from other PC2 Series programmable controllers accessible via ME-NET or High Speed PC Link (HPC).

Supported Devices

Toyoda Toyopuc PC2 Series Programmable Controllers that:

- Have installed an Ethernet EN-IF card at revision level V2.1or later.
- Are networked via ME-NET or HPC to a PC2 Series Programmable controller with an installed EN-IF Ethernet card at revision level V2.1 or later

Required Hardware/Software

You must have the following:

- Toyopuc PC2 Series Programmable Controller with EN-I/F card (V2.1)
- PC with Ethernet card installed.
- Windows NT 4.0 with Service Pack 3
  (TCP/IP Communications must be installed and configured)
- CIMPLICITY HMI 4.0

Toyopuc Programmable Controller Configuration Requirements

Hardware Setup

All installed I/O, communications cards, must be configured and downloaded to your programmable controller.

Toyopuc Ethernet Card Configuration Requirements

The EN-IF Ethernet Card must be configured into the programmable controller via Hellowin or GL1 programming software.
The EN-IF Ethernet card is setup by writing ladder logic to configure the card's IP address and Ethernet communication port. Non-specific Passive Communication setup with a non-zero non-reception timer is recommended.

Toyopuc Ethernet Device Communication Module Related Documents

- *Programmable Controller TOYOPUC PC2 series EN-I/F Instruction Manual – T-8765N*
- *Toyopuc Programmable Logic Controller INSTRUCTION MANUAL FOR your Toyopuc Processor*
- *Toyopuc Programmable Logic Controller INSTRUCTION MANUAL FOR GL1 PROGRAMMER FOR PC 2 Series*
- *Toyopuc Programmable Logic Controller GL1 Common Module for IBM PC/AT COMPATIBLE COMPUTERS – INSTRUCTION MANUAL*
- *Toyopuc HelloWin Programmer for PC3/2 Series Instruction Manual*
- *Toyopuc Programmable Logic Controller – High Speed PC Link*
- *Toyopuc Programmable Logic Controller – ME-NET*

Communication Configuration Checklist

Please follow these instructions for configuring your Ethernet configuration prior to trying to use this communication interface. *If your PC and/or programmable controllers are to be connected to a standardized or company-wide network, please contact your network administrator for the specific hostnames, IP addresses and socket port numbers used in your setup.*
Install an Ethernet card in your PC.

1. Configure the minimum TCP/IP Communications for your PC. This includes assigning a name and TCP/IP address for the computer.
2. Assign A TCP/IP address and socket port for each TCP/IP connection to be used on your PC2 Series programmable controller.
3. Setup each EN-IF Ethernet card that will be used to communicate with CIMPLICITY HMI.
4. Configure the TCP/IP address for each connection to a PC2 series programmable controller in the host file. *(See Device Address specification for additional information)*
5. Verify Ethernet connectivity to the each PC2 connection that has a unique IP address by pinging the processor. Using the name configured for the programmable controller, execute the command

   ping <name>
6. Using the test program, *toyopuc_diag*, included with this software distribution, verify communications with each PC2 programmer for each connection that will be used in your CIMPLICITY HMI application.
7. Develop and run your CIMPLICITY HMI application that collects data from Toyopuc PC2 Series programmable controllers.

Using Toyopuc_diag

The diagnostic program, *toyopuc_diag*, may be use to read and write data to a Toyopuc PC2 series programmable controller, accessible via Ethernet (including those networked to such a programmable controller via ME-NET or HPC).

To use the diagnostic program, you will first need to go to the configuration cabinet for your project and do the following:

Open your project's Configuration cabinet.

1. Select Command Prompt, from the Tools menu, to open an MS-DOS window.
2. In the MS-DOS window, type the following at the MS-DOS prompt:

```
toyopuc_diag  <device_address> <memory_address>
<element_count> <command> [ data]
```

(The typed line is on two lines here for display purpose. Type it on one line at the MS-DOS prompt.)

Note: Please review the sections of this document titled “Device Address Specification” for the format of the device address, and the section titled “Toyopuc Ethernet Communications Supported Memory Types” for the format and range of memory addresses.

The available commands are:

-r Read the data and display results in decimal

-h Read the data and display results in hex

-w Write the data. Values to be written are entered in decimal.

-x Write the data. Values to be written are entered in hex.

To read the first 3 data registers on the programmable controller toyopuc accessible through socket port 4096, the following command would be entered at the DOS prompt.

```
toyopuc_diag toyopuc/4096 d0 3 –r
```

For example, the following command would be used to write to the first 3 data registers on the toyopuc programmable controller (setting d0 to 100, d1 to 200 and d2 to 300):

```
Toyopuc_diag toyopuc/4096 d0 3 –w 100 200 300
```

Application Configuration when using Toyopuc Communications Enabler

As with other CIMPLICITY HMI software communications enablers, you must complete the Port, Resource, Device and Device Point Configuration to setup the Toyopuc Ethernet Communications.

For more information on port, device, and point configuration functions, see the CIMPLICITY HMI Base System User's Manual (GFK-1180).

Toyopuc Port Configuration

When you configure a port for Toyopuc Ethernet communications, the *New Port* dialog box opens.

Use the *General Properties* tab to enter general information for the port. You can define the following:

Description Enter an optional description to help you identify the port.

Scan Rate Enter the base scan rate for the port. Point scan rates will be multiples of the base rate.

You can specify a scan rate in Ticks (100 ticks = 1 second), Seconds, Minutes, or Hours.

Retry Count If communications cannot be established to a device on this port, the device is considered to be down and a $DEVICE_DOWN alarm is generated. Once a device is down, periodic attempts are made to resume connection to it.

Enter the number of scans to wait before attempting to reconnect to a device on this port after a communications error is detected.

Enable Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Toyopuc Device Configuration

When you configure a Toyopuc device, the *Device Properties* dialog for devices using this protocol opens.

Use the *General Properties* tab to enter general information for the device. You can define the following:

Port — Select the port for this device. You can click the Browser button - - to the right of the field to display the list of ports and select one.

You can click the Pop-up Menu button - - to create a new port, edit the current port, or select a port from the list of ports.

Description — Enter an optional description to help you identify the device.

Resource — Enter a resource that can be associated with this device for alarm generation.

Model type — Enter PC2

Use the default properties to enter information about communications for the device. You can define the following:

Address — Enter the device address following the specification in the *Device Addresses* section.

CPU — Enter 0

Enable — Set this check box to enable the device when the project starts. If you clear this check box, the device will not be enabled and points associated with the device will be unavailable.

Device Address Specification

The **device address** should have one of the following formats:

For a programmable controller directly connected to the Ethernet network.

<HOSTNAME>/<SOCKET PORT NUMBER>

For a programmable controller that is accessible through another PC2 programmable controller that is connected via Ethernet, the format is:

<HOSTNAME>/<ROUTING INFORMATION>/<SOCKET PORT NUMBER>

Routing for a hierarchy of up to 4 levels is supported. The format of the routing information for a one level hierarchy is:

<LINK NUMBER>:<EXCHANGE NUMBER>

On a PC2 that is indirectly accessed via an HPC network, the Exchange Number is the Station Number.

The format of the routing information for a 4 level hierarchy is:

<LINK NUMBER>:<EXCHANGE NUMBER>.<LINK NUMBER>:<EXCHANGE NUMBER>.<LINK NUMBER>:<EXCHANGE NUMBER>.<LINK NUMBER>:<EXCHANGE NUMBER>

(The routing information above is on three lines for display purposes. When you are using it, type it on one line.)

Periods (.) separate the routing information for each level of the hierarchy.

Host Name Specification

The hostname for each connection must exist in the hosts file.

On Windows NT Systems, this file is: located on the system drive in *\WINNT\System32\drivers\etc\hosts*

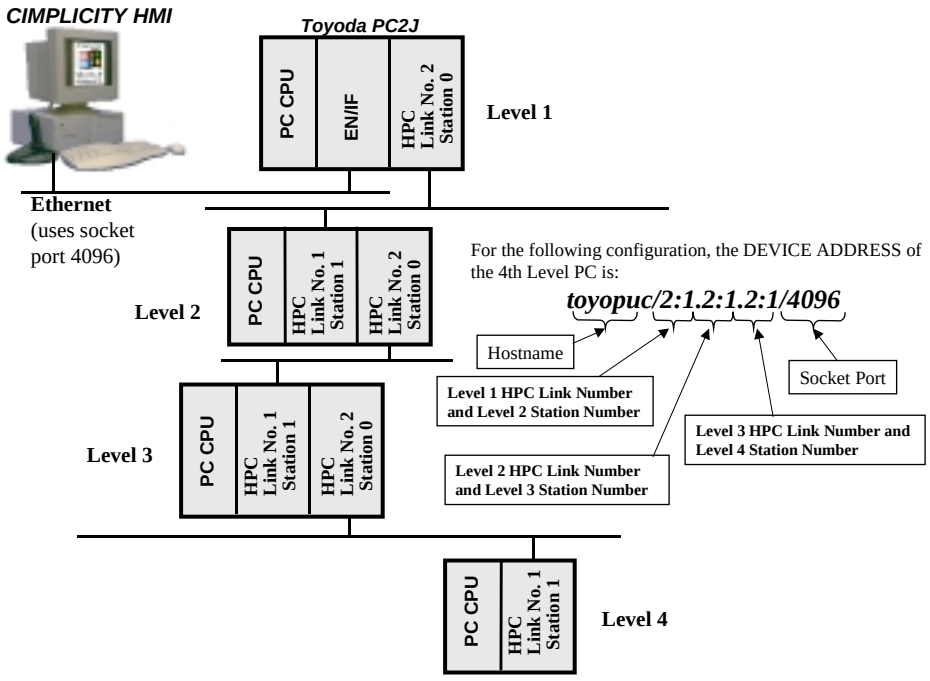
The file may be edited using any text editor.

The format of the host files is:

<IP_address> <name> <alias>

To specify a host named toyopuc1 at an IP Address of 192.1.0.2, the entry would be:

Example Device Address Specification


CIMPLICITY HMI
Toyoda PC2J
PC CPU
EN/IF
HPC Link No. 2 Station 0
Level 1
Ethernet
(uses socket port 4096)
PC CPU
HPC Link No. 1 Station 1
HPC Link No. 2 Station 0
Level 2
For the following configuration, the DEVICE ADDRESS of the 4th Level PC is:
toyopuc/2:1.2:1.2:1.2:1/4096
Hostname
Socket Port
Level 1 HPC Link Number and Level 2 Station Number
Level 3 HPC Link Number and Level 4 Station Number
Level 2 HPC Link Number and Level 3 Station Number
Level 3
PC CPU
HPC Link No. 1 Station 1
HPC Link No. 2 Station 0
PC CPU
HPC Link No. 1 Station 1
Level 4

Toyopuc Point Configuration

Once your devices are configured, you many configure points for them. The fields described below have configuration values that are unique to or have special meaning to Toyopuc Ethernet communications.

General Page

On the General property page, you may configure points for Read or Read/Write access.

Device Page

On the Device property page:.

Update Criteria

The update criteria determine how the data will be collected and/or updated in your CIMPLICITY HMI software application.

- Enter **On Change** or **On Scan** for points whose values should be polled by the Toyopuc Ethernet Communications Driver at regular intervals.
- Enter **On Demand On Scan** or **On Demand On Change** for points whose values should be polled by the Toyopuc Ethernet at regular intervals while users are viewing them.

Address

Enter the point address. For device points, valid address and ranges are described under *Toyopuc Ethernet Communications Supported Memory Types.*

This communication interface supports the diagnostic points defined in the *CIMPLICITY HMI User's Manual* under point configuration. In addition, the following diagnostic points may be configured for devices that use this communication interface:

Point Address	Description	Valid Point Types
$CONNECT_STATUS	Shows status of connect 0 = CONNECTED 1 = NO CONNECTION	SINT, USINT
$AVG_CONNECT_TIME	Average amount of time it took to successfully connect to the device in the last $SAMPLE_CONNECT_SIZE attempts. (Time unit is in seconds and fractions of seconds.)	REAL
SAMPLE_CONNECT_SIZE	Number of data values used for average connect time calculation	INT, UINT
$HI_CONNECT_TIME	Longer amount of time to connect to device since the communication enabler was started (Time unit is in seconds and fractions of seconds.)	REAL
$LO_CONNECT_TIME	Smallest amount of time to connect to device since the communication enabler was started (Time unit is in seconds and fractions of seconds.)	REAL
$AVG_READ_TIME	Average amount of time it took to successfully read from the device in the last $SAMPLE_READ_SIZE attempts. (Time unit is in seconds and fractions of seconds.)	REAL
$SAMPLE_READ_SIZE	Number of data values used for average read time calculation	INT, UINT
$HI_READ_TIME	Longer amount of time to read from device since the communication enabler was started (Time unit is in seconds and fractions of seconds.)	REAL
$LO_READ_TIME	Smallest amount of time to read from the device since the communication enabler was started (Time unit is in seconds and fractions of seconds.)	REAL
$AVG_WRITE_TIME	Average amount of time it took to successfully write to the device in the last $SAMPLE_WRITE_SIZE attempts. (Time unit is in seconds and fractions of seconds.)	REAL
$SAMPLE_WRITE_SIZE	Number of data values used for average write time calculation	INT, UINT
$HI_WRITE_TIME	Longer amount of time to write to device since the communication enabler was started (Time unit is in seconds and fractions of seconds.)	REAL
$LO_WRITE_TIME	Smallest amount of time to read from the device since the communication enabler was started (Time unit is in seconds and fractions of seconds.)	REAL

Toyopuc Ethernet Communications Supported Memory Types

The following elements are accessible from this communication interface.

Name	I/O Address And Maximum Range	Access
Edge Relay	P000 – P1FF	Read/Write
Keep Relay	K000 – K2FF	Read/Write
Specific Relay	V00 – VFF	Read/Write
Timer/Counter	T000 - T1FF or C000 – C1FF	Read/Write
Link Relay	L000 – L7FF	Read/Write
I/O Relay	X0000 – X7FF or Y000 – Y7FF	Read/Write
Internal Relay	M000 – M7FF	Read/Write
Specific Register	S000 – S3FF	Read/Write
Timer/Counter Current Value	N000 – N1FF	Read/Write
Link Register	R000 – R7FF	Read/Write
Data Register	D0000 – D2FFF	Read/Write
File Register	B000 – B1FFF	Read/Write
CPU Status .	SY0 – SY8	Read

Advanced Configuration Requirements

You can adjust the timing and performance characteristics of the Toyopuc communications by changing or defining the global parameters listed below.

These global parameters are defined in the CIMPLICITY HMI global parameters file. This file is located in your project's \data directory and is named **`glb_parms.idt`**. *For detailed information on editing this file and the format used by its records, see the "System Management" chapter in the "GFK-1180– Base System User's Manual"* .

<PRCNAM>_CONNECTION_TIMEOUT - Number of seconds the communication enabler should wait for a connect operation to complete. Recommend value is 5. Default value is 10.

<PRCNAM>_READ_WRITE_TIMEOUT - Number of seconds the communication enabler should wait for a read or write operation to complete. Recommend value is 3. Default value is 10.

Triplex Communications

About Series 90 TCP/IP Triplex

The Series 90 TCP/IP Triplex enabler supports both cabling redundancy and PLC redundancy for Series 90 TCP/IP communications.

- ***PLC redundancy*** describes the ability to configure a group of PLCs to act as a single logical data source.
- ***Cabling redundancy*** describes the ability to configure two network paths to the same PLC.

The enabler supports the standard GE Fanuc Series 90-70 hot-standby, synchronized CPU and GMR system products, Trimations HBR-30, HBR-70, and TMR-30 products and, custom redundancy applications based on GE Fanuc Series 90 PLC products.

Reviewing Series 90 TCP/IP Redundancy

The Series 90 TCP/IP Triplex enabler allows CIMPLICITY HMI to interface to PLC groups comprising up to 3 PLCs with up to 2 network paths per device.

Cabling redundancy operates in *Hot-Standby* mode; it communicates to the PLC using the first path while monitoring the second path. It switches automatically, without PLC intervention, to the second path if the first path fails. It continues to monitor the first path and will automatically switch back to the first path on recovery.

PLC redundancy also operates in *Hot Standby* mode, it communicates with the highest-ranking PLC and automatically switches to a lower ranking PLC in the event of the failure of the highest-ranking PLC. It continues to monitor the PLCs and will automatically switch back to a higher-ranking PLC on recovery.

CIMPLICITY software maintains connection and status information for all the PLCs in a PLC group, but only reads data from the active master. To the user, the physical devices in the same group are viewed as a single logical device. Points are configured for the logical device thus eliminating the need for duplicate configuration.

Logical devices are configured by entering multiple TCP/IP addresses, either one or two for each PLC in the group. When the enabler starts, the primary PLC is the master and the other PLCs are in *Hot-Standby* (slave) mode. Under normal operating conditions, the enabler reads data from and writes data to the master PLC, while checking the "health" of the slave PLC(s).

The enabler requires the redundant PLC group to communicate with each other and to indicate (via a mode flag) which programmable controller is the master or is capable of operating as master PLC. The enabler is responsible for selecting the highest-ranking PLC as the active master.

Important: Since the Mode Address is specified at the port level, all redundant PLCs associated with a port must use the same Mode Address. This means that all PLCs on the port must have the same model type (that is all 90-70s or all 90-30s).

PLC Redundancy

The Series 90 TCP/IP Triplex Communications enabler can be configured for PLC groups of up to 3 PLCs. The PLCs are ranked in order of importance Primary (PLCA)⇒Secondary (PLCB)⇒Third (PLCC).

The enabler reads and writes data to the highest-ranking PLC. Since the CIMPLICITY data points for this PLC group are only defined once, it is a requirement that the PLCs use the same memory references.

To determine the status of each of the PLCs in the PLC group, the enabler uses:

- The network connection status (up/down),
- The PLC status (running/stopped) and
- Two mode bits per PLC.

The two mode bits designated Health and Master are controlled by the PLCs and have the following meanings:

- ***Health***, the PLC is healthy - passes internal checks and is operating correctly.
- ***Master***, the PLC has performed all initialization actions and data can be read from this device.

The enabler uses the highest ranked running PLC with a network path that has both the Health and Master bits set.

The write and read behavior can be modified by configuration options as follows:

- PLC writes can be modified by a configuration radio button to cause writes to be performed to all PLCs
- PLC reads can be modified by a configuration check box to ignore the Master bit in which case data will be read from the highest ranking running healthy PLC with a network connection.

Cabling Redundancy

The Series 90 TCP/IP Triplex Communications enabler can be configured for one or two network communications paths to each device in a PLC group.

CIMPLICITY normally uses the primary cable address and monitors the secondary. If the primary cable address fails, the enabler automatically switches to the secondary. The enabler continues to monitor the primary and will automatically switch back should it recover.

Cabling redundancy can be implemented with:

- One Ethernet LAN with two connections from each PLC to the Ethernet LAN.
- A redundant Ethernet LAN and one connection from each PLC to both of the Ethernet LAN's.

When multiple Ethernet cards are used in the host computer, the Host IP Address and PLC IP Address in combination with the Subnet Mask of the Ethernet card determines which card/cable combination will be used.

Series 90 TCP/IP Redundancy Failure Conditions and Actions

The enabler responds to fault condition as follows:

Communication/PLC Failure

A communication/PLC failure occurs where the enabler can no longer communicate over any network path to a running healthy PLC; for example network down, PLC powered down, PLC stopped or Health bit clear.

- Master PLC - the enabler updates the diagnostic points then performs a failover to the next highest ranking running Healthy PLC with the Health and master mode bits set.
- Standby PLC - the enabler updates the diagnostic points for the PLC.

The enabler then retries communications to the failed PLC at the configured heartbeat rate.

Communication/PLC Recovery

A communication/PLC recovery occurs where the enabler re-establishes communication over a network path to a running healthy PLC; for example network recovered, PLC powered up or Health bit becomes set. .

The action taken by the enabler depends on the ranking of the PLC.

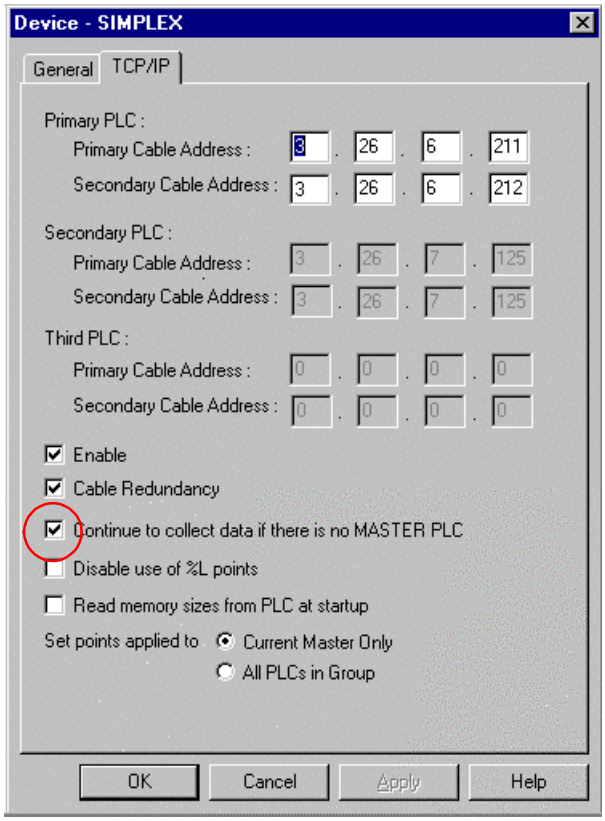
- Higher Ranking PLC - the enabler checks the Health and Master bits. It updates the diagnostic points for the PLC. If both mode bits are set, the enabler selects this PLC as the current master.
- Lower Ranking PLC - the enabler checks the Health and Master bits and, updates the diagnostic points for the PLC.

Mode bits: No Current Master

The enabler updates the diagnostic points and no further communication takes place to any PLC in the group.

The enabler continues to monitor the mode bits at the configured heartbeat timer interval.

This feature can be modified by checking Continue to collect data if there is no MASTER PLC on the TCP/IP tab in the Device Properties dialog box.


Device - SIMPLEX
General
TCP/IP
Primary PLC :
Primary Cable Address : 3 . 26 . 6 . 211
Secondary Cable Address : 3 . 26 . 6 . 212
Secondary PLC :
Primary Cable Address : 3 . 26 . 7 . 125
Secondary Cable Address : 3 . 26 . 7 . 125
Third PLC :
Primary Cable Address : 0 . 0 . 0 . 0
Secondary Cable Address : 0 . 0 . 0 . 0
Enable
Cable Redundancy
Continue to collect data if there is no MASTER PLC
Disable use of %L points
Read memory sizes from PLC at startup
Set points applied to
Current Master Only
All PLCs in Group
OK
Cancel
Apply
Help

Mode bits: Multiple Masters

The enabler updates the diagnostic points and communicates with the highest-ranking PLC.

The enabler continues to monitor the mode bits at the configured heartbeat timer interval...

Configuring Series 90 TCP/IP Triplex Applications

When you are configuring ports, devices, and device points, most of the information required is identical to the information required for the Series 90 TCP/IP communication enabler (non-redundant).

The differences are:

- When creating a Project, select the S90_Triplex protocol.
- You must configure a Mode Address field and a Heartbeat Timer field in the Port Properties dialog box.

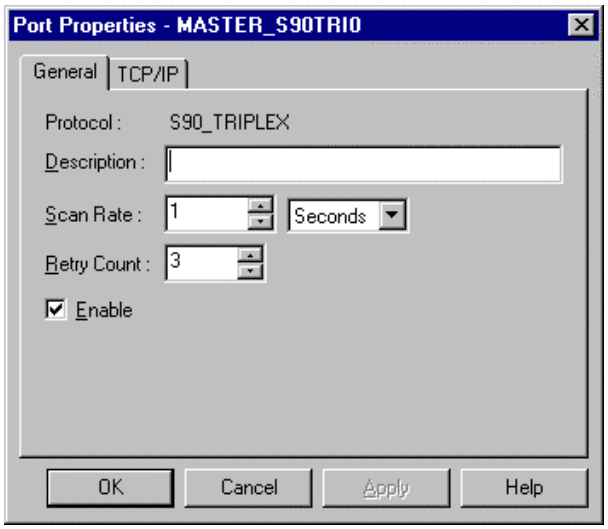
Configuring a Series 90 TCP/IP Triplex Port

When you create a new port for Series 90 TCP/IP Triplex communications, enter the following information in the New Port dialog box:

1. In the Protocol field, select S90_TRIPLEX from the list of available protocols.
2. In the Port field, select the communication port that will be used for Series 90 TCP/IP Triplex communications.

When you click **OK** to create the port, the Port Properties dialog box for the protocol opens.

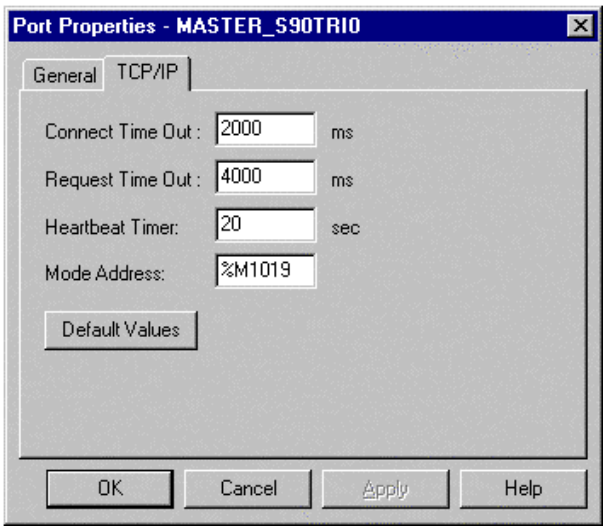
Port General Properties



Use the General tab in the Port Properties dialog box to enter general information for the port. You can define the following:

Description	Enter an optional description to help you identify the port.
Scan Rate	Enter the base scan rate for the port. Point scan rates will be multiples of the base rate. You can specify a scan rate in Ticks (100 ticks = 1second), Seconds, Minutes, or Hours.
Retry Count	If the enabler can not complete a setpoint (write/download) to a device due to any reason, retries are performed. Enter the number of retries to perform before reporting the action as “failed”.
Enable	Set this check box if you want the port to be enabled when the project starts. If you clear this check box, the port will not be enabled when the project starts, and points will not be available for devices on the port.

Port TCP/IP Properties



Use the TCP/IP tab in the Port Properties dialog box to enter information about TCP/IP communications for the port. You can define the following:

Connect Time Out	Enter the number of milliseconds to wait when making a connect request to a device.
Request Time Out	Enter the number of milliseconds to wait when waiting for a request to complete.
Heartbeat Timer	Each Series 90 controller in a redundant group will be probed at the "Heartbeat" interval to determine the state of the device. Enter a value in seconds that will be the "Heartbeat" interval for probing the Series 90 controllers. If the value entered is lower than 45 seconds (Windows NT default connection retry interval), *ghost* TCP/IP connections could be established to a PLC when a PLC is brought back on-line. *Refer to the steps described in the Advanced Configuration Section of this document to avoid this issue.*

Mode Address

Enter the starting address of the location of two consecutive status bits in digital memory that indicate the current state of the programmable controller.

- The first bit indicates the overall health of the programmable controller (1=Healthy).
  The Series 90 nickname for this bit is **LOC_READY**
- The second bit indicates whether the programmable controller is the current master in the redundant group (1=master).
  The Series 90 nickname for this bit is LOC_ACT.

Both status bits should be set by logic in the Series 90 controller, and will be read at the "Heartbeat" interval.

This address must be a legal address in the Series 90 controller or the heartbeat will fail.

Recommend % S35 for Series 90-70.

Recommend % M1019 for Series 90-30.

When you configure a Mode Address for 90-70 or 90-30 Simplex devices, make sure that the status bits in the PLC are set to 1 (one).

Click **Default Values** if you want to use the factory default values. The default values are:

Connect Time Out	1000 ms (1 second)
Request Time Out	5000 ms (5 seconds)
Heartbeat Timer	120 seconds (2 minutes)
Mode Address	%M1019

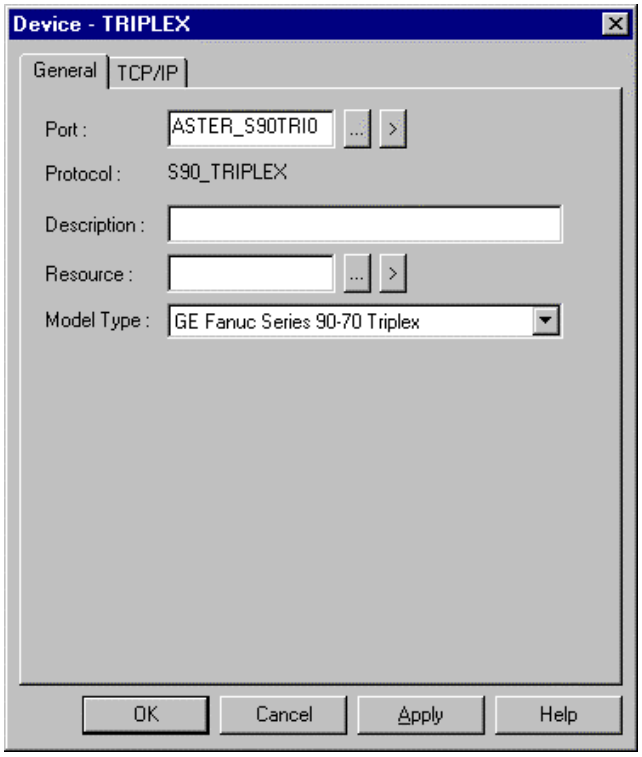
Configuring a Series 90 TCP/IP Triplex Device

When you create a new device for TCP/IP Triplex communications, enter the following information in the New Device dialog box:

1. In the Device field, enter the name of the logical device you are configuring.
2. In the **Port** field, select the Series 90 TCP/IP Triplex port to be used by this device.

When you click **OK** to create the device, the Device Properties dialog box opens.

Device General Properties



Use the General tab in the Device Properties dialog box to enter general information for the device. You can define the following:

Port — Select the port for this device.

- Click the **Browser** button ... to the right of the field to display the list of ports and select one.
- Can click the **Pop-up Menu** button > to create a new port, edit the current port, or select a port from the list of ports.

Description — Enter an optional description to help you identify the device.

Resource — Select the resource for this device.

- Click the **Browser** button ... to the right of the field to display the list of resources and select one.
- Click the **Pop-up Menu** button > to create a new resource, edit the current resource, or select a resource from the list of resources.

Model Type

Select the type of device. Click the drop-down button to the right of the input field to display your choices, then make a selection. For this protocol, the choices are:

GE Fanuc Series 90-70 Simplex

GE Fanuc Series 90-70 Duplex

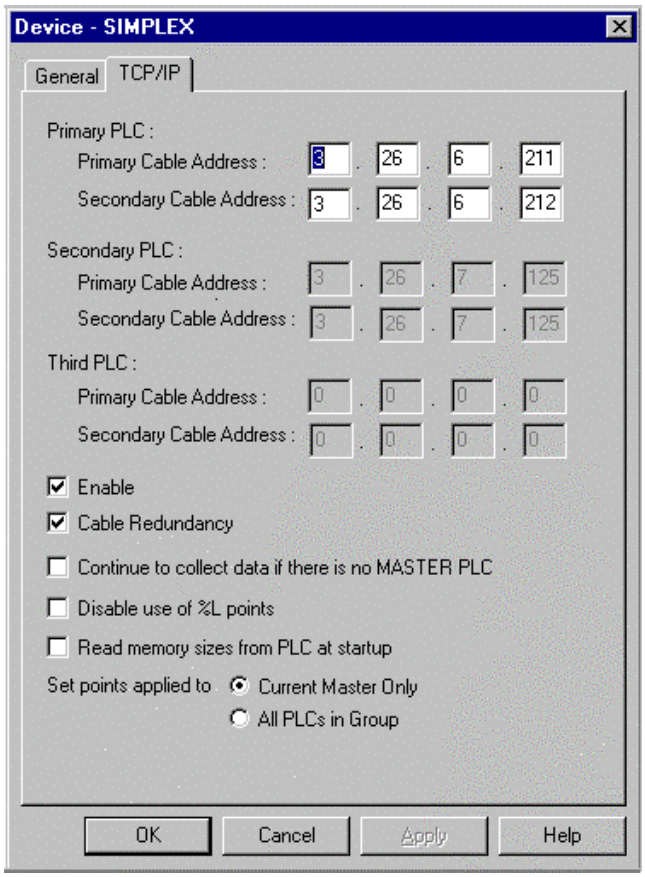
GE Fanuc Series 90-70 Triplex

GE Fanuc Series 90-30 Simplex

GE Fanuc Series 90-30 Duplex

GE Fanuc Series 90-30 Triplex

Device TCP/IP Properties


Device - SIMPLEX
General
TCP/IP
Primary PLC :
Primary Cable Address : 3 . 26 . 6 . 211
Secondary Cable Address : 3 . 26 . 6 . 212
Secondary PLC :
Primary Cable Address : 3 . 26 . 7 . 125
Secondary Cable Address : 3 . 26 . 7 . 125
Third PLC :
Primary Cable Address : 0 . 0 . 0 . 0
Secondary Cable Address : 0 . 0 . 0 . 0
Enable
Cable Redundancy
Continue to collect data if there is no MASTER PLC
Disable use of %L points
Read memory sizes from PLC at startup
Set points applied to
Current Master Only
All PLCs in Group
OK
Cancel
Apply
Help

Use the TCP/IP tab in the Device Properties dialog box to enter information about TCP/IP communications for the device.

You can define the following:

Primary PLC of the redundant group:

Primary Cable Address	Enter the IP address of the primary Ethernet card in the Primary PLC Primary Cable Address field.
Secondary Cable Address	This field is available only if you select the Cable Redundancy option. Enter the IP address of the secondary Ethernet card in the Primary PLC Secondary Cable Address field.

Secondary PLC: Duplex or **Triplex** selected for the device model

Primary Cable Address	Enter the IP address of the primary Ethernet card in the secondary PLC Primary Cable Address field.
Secondary Cable Address	This field is available only if you select the Cable Redundancy option. Enter the IP address of the secondary Ethernet card in the secondary PLC Secondary Cable Address field.

Third PLC: Triplex selected for the device model

Primary Cable Address	Enter the IP address of the primary Ethernet card in the Third PLC Primary Cable Address field.
Secondary Cable Address	This field is available only if you select the Cable Redundancy option. Enter the IP address of the secondary Ethernet card in the Third PLC Secondary Cable Address field.

Device options include:

Enable	Select this check box to enable the device when the project starts. If you clear this check box, the device will not be enabled and points associated with the device will be unavailable.
Cable Redundancy	Select this check box if redundant cabling is being used for this device. If you clear this check box, the Secondary Cable Address fields in this dialog box are disabled.
Continue to Collect Data if there is No Master PLC	By default, when the Series 90 TCP/IP Redundant Communications enabler loses its connection to the master PLC of a redundant group and the slave PLC(s) fail to set its Master bit, the enabler marks the device down. All points go (and remain) "Unavailable" until one of the PLCs declares itself the master. You can select this check box to change this behavior so that when the master PLC of a redundant group fails, and no other PLC declares itself the master, the enabler automatically starts collecting data from the highest-ranking slave PLC.

Disable use of %L points	By default, the Series 90 TCP/IP Redundant Communications enabler validates %L device points by reading Program Blocks from the PLC. This may increase the length of time it takes to start the enabler. If you do not use %L points in your project, you can change the enabler, via selecting the corresponding button, to skip this validation.
Read Memory Sizes from PLC at Startup	On start up, the Series 90 TCP/IP Redundant Communications enabler must obtain the size of each Memory type in the PLC. The enabler saves this configuration for faster initialization on subsequent starts. By default, the enabler will use this saved configuration instead of reading the configuration from the PLC. You can change the enabler, via selecting the corresponding button, to obtain the sizes from the attached PLC.
Set Points Applied to	By default, the Series 90 TCP/IP Redundant Communications enabler only reads data from and writes data to the active master. You can change the enabler, via selecting the corresponding button, to write data to all the programmable controllers in the redundant group.

Configuring Series 90 TCP/IP Triplex Points

When you define a point, the following fields have values that are unique to or have special meanings for Series 90 TCP/IP Triplex communications.

Point General Properties

On the General tab in the Point Properties dialog box you may configure points for Read or Read/Write access.

Point Device Properties

On the Device tab in the Point Properties dialog box, configure the:

Address

For all memory types except %L, enter the memory type and offset in the Address field. The address format is:

```
<memory type><address>
```

For example, to specify Register 1, the address is %R1. All offsets have a minimum value of 1.

The address of %L memory types requires the block name. Block names ***must*** be unique over all programs in the programmable controller.

Block names cannot begin with a numeric character.

The address format is:

```
%L<address><block name>
```

For example, to specify the fifth word in the %L domain in the program block ABC, the address is %L5ABC.

In addition to the standard diagnostic points, you can configure a set of Series 90 TCP/IP Triplex diagnostic points. The data structure type of all diagnostic points is UINT.

Update Criteria

The update criteria determine how the data will be requested.

Select On Change or On Scan for points whose values should be polled by Series 90 TCP/IP communications at regular intervals.

Select On Demand On Change or On Demand On Scan for points whose values should be polled by Series 90 TCP/IP communications at regular intervals when users are viewing them.

Point Type

Select one of the following:

- For device points, select Normal.
- For diagnostic points, select Diagnostic. The Redundant TCP/IP Communications enabler uses the standard diagnostic points as well as the diagnostic points described below.

When you are configuring Boolean points in memory types that are not bit addressable, you must also enter data in the following field:

Address Offset

Enter the bit offset that corresponds to the bit position within the word.

Reviewing Series 90 TCP/IP Triplex Diagnostic Points

You can configure a set of diagnostic points for each CIMPLICITY device. Each diagnostic point is automatically updated by the enabler at runtime to indicate the status of the controllers. There are three diagnostic points that are unique for the TCP/IP Redundancy device communication enabler.

- The Mode point provides information about each device.
- The Status point provides an overall indication of the state of the device/cable.
- The Data Source point indicates which device/cable is supplying the current data.

Mode Diagnostic Points

You can create a mode point for each physical PLC. The point contains the following information:

Description	Bit	Value
Device health	1	1 = device OK
Current master	2	1 = current master
CPU Status	3	1 = CPU is running

The first and second bits contain the mode information from the programmable controller. The mode address is defined in the Mode Address field on the TCP/IP tab in the Port Properties dialog box when you create the port.

The third bit indicates the status of the CPU. The CPU is considered to be *not in run mode* if its state is any of the following:

- **STOP_IO_DISABLED**
- **CPU_STOP_FAULTED**
- **CPU_HALTED**
- **CPU_SUSPEN**DED
- **STOP_IO_ENABLED**

The addresses for the Mode diagnostic points are:

$MODE_P1	Mode Point - Primary PLC
$MODE_P2	Mode Point - Secondary PLC
$MODE_P3	Mode Point - Third PLC

Status Diagnostic Point

You can create a Status point for each cable connection. If configured, the point will be set to one of the following values:

Value	Description
0	OK–Indicates the enabler can connect to the PLC over this cable and the PLC has the expected state.
1	NOT OK–Indicates there is a problem with either the cable connection or the state of the PLC.
2	This cable is not configured.

The addresses for the Status diagnostic points are:

$CONN_STATUS_P1C1 Status Point–Primary PLC over Primary Cable

$CONN_STATUS_P1C2 Status Point–Primary PLC over Secondary Cable

$CONN_STATUS_P2C1 Status Point–Secondary PLC over Primary Cable

$CONN_STATUS_P2C2 Status Point–Secondary PLC over Secondary Cable

$CONN_STATUS_P3C1 Status Point–Third PLC over Primary Cable

$CONN_STATUS_P3C2 Status Point–Third PLC over Secondary Cable

Data Source Diagnostic Point

You can create a Data Source point for each logical CIMPLICITY device. If configured, the point will be set to one of the following values:

Value	Description
0	No communication on any cable
1	Current data is collected from the Primary PLC over the Primary Cable
2	Current data is collected from the Primary PLC over the Secondary cable.
3	Current data is collected from the Secondary PLC over the Primary Cable.
4	Current data is collected from the Secondary PLC over the Secondary Cable.
5	Current data is collected from the Third PLC over the Primary Cable.
6	Current data is collected from the Third PLC over the Secondary Cable.

The addresses for the Status diagnostic point is:

$DATA_SOURCE	Data Source Point

Series 90 TCP/IP Triplex Advanced Configuration Topics

Advanced topics include:

- **`TcpMaxConnectRetransmission`** parameter.

TcpMaxConnectRetransmissions

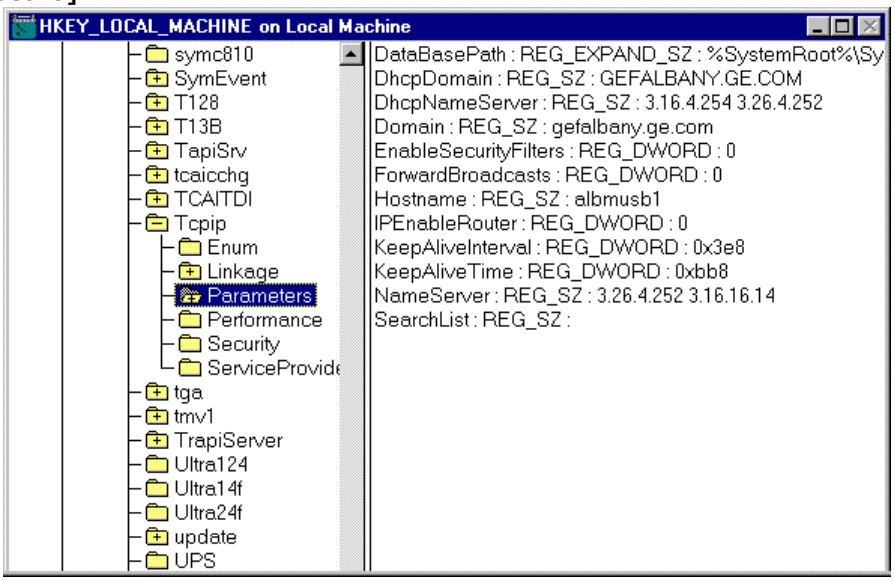
To avoid ***ghost*** connections (connections that are established at the operating system level, but not recognized by the enabler) when the heartbeat interval is configured lower than 45 seconds, follow this procedure to change the registry configuration for **`TcpMaxConnectRetransmissions`**.

To change the registry configuration for TcpMax Connect Retransmisisons:

1. Run **`regedt32`** from a command prompt.

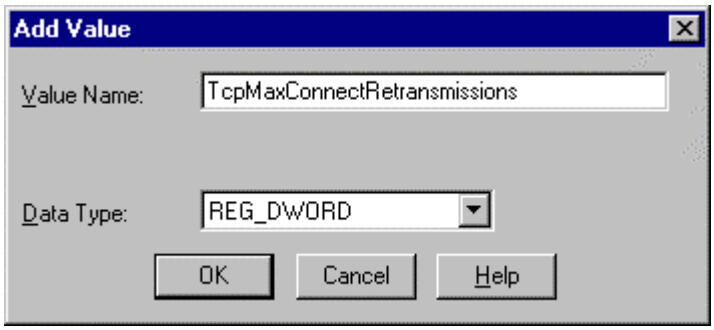
   The Registry Editor window opens.

2. Follow the tree to:
   `[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters]`



3. Click Edit on the Registry Editor menu bar.
4. Select Add Value from the menu.
5. Enter TcpMaxConnectRetransmissions in the Value Name field.

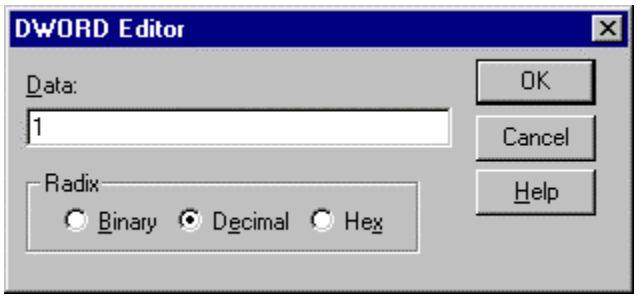
6. Select REG_DWORD in the Data type field.



7. Click **OK**.

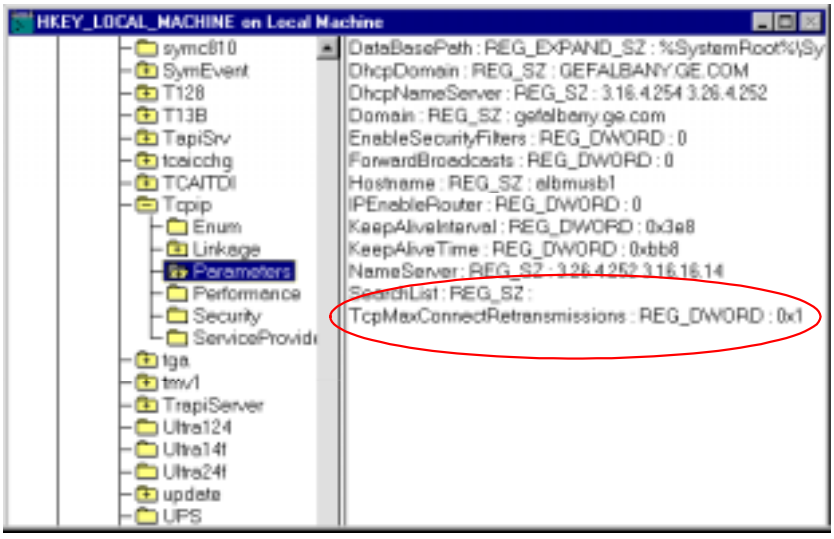
   The DWORD Editor opens.

8. Enter the integer 1 in the Data field.
9. Check Decimal.



10. Click **OK**

    The **`TcpMaxConnectRetransmissions`** parameter displays in the Registry Editor right pane.



11. Exit the Registry Editor and restart your computer.

Triplex Enabler used with Server Redundancy

The Series 90 TCP/IP Triplex enabler is among the communication interfaces that are supported in CIMPLICITY HMI Server Redundant configurations. The enabler on the slave node will *heartbeat* all communication paths of the configured devices. If a problem is detected, an alarm will be generated to indicate the communication path in error.

On the Primary Server, alarms indicating individual communication path errors are NOT generated automatically. Diagnostic points that indicate the status of the individual paths can be configured to have an Alarm condition. Since diagnostic points do not reflect the status of the communication paths on the Slave Server, the enabler on the slave node generates alarms to reflect status.

Failure Conditions and Actions using Triplex Enabler

The enabler responds to fault condition as follows.

Server Failure

A Server failure occurs when the Secondary Server can no longer communicate to the Primary Server; for example; the project on Primary Server stopped.

The enabler on the slave node becomes the active master and begins collecting data from the highest ranking running Healthy PLC with the Health and master mode bits set.

The enabler updates the diagnostic points to reflect the status of connections on the new active master node. .

Server Recovery

A Server recovery occurs when the Configured Primary server becomes active and a transition takes place. .

The enabler on the *new* slave node suspends polling the devices, and returns to *heartbeat* processing.

The enabler on the recovered node becomes the active master and begins collecting data from the highest ranking running Healthy PLC with the Health and master mode bits set.

Communication Path Failure detected by the Slave Enabler

A communication path failure occurs when the enabler on the Secondary Server can no longer communicate over a configured communication path to a PLC. .

The enabler generates a $DEVICE alarm to indicate the communication path in error. After all paths to the device are tested, a "summary" alarm is generated if necessary. The text of the alarm message contains an error code, which is an integer that indicates the connection status of each path. If you turn the error code into a bit string, the bits can be interpreted as follows:

bit 0: primary PLC primary cable

bit 1: primary PLC secondary cable

bit 2: secondary PLC primary cable

bit 3: secondary PLC secondary cable

bit 4: third PLC primary cable

bit 5: third PLC secondary cable

If the bit is equal to 1, then the enabler can not communicate over that path. As an example, if both cables to the Primary PLC are disconnected, but all other paths are operational, bits 0 and 1 would equal 1, so the error code would equal 3 (000011 = 3).

Communication Path Recovery detected by the Slave Enabler

A communication path recovery occurs where the enabler re-establishes communication over a network path to a PLC..

If all communication paths are now operational to the device, a $DEVICE alarm is generated to indicate full recovery. If a different communication path still is in error, a $DEVICE alarm is generated as described above.

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